

Sutter Basin Pilot Feasibility Study Mitigation and Monitoring Plan

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List of Abbreviated Terms

AEP	annual exceedance probability
BSSCP	bentonite slurry spill contingency plan
CAPP	Conceptual Area Protection Plans
CDFW	California Department of Fish and Wildlife
CH	fat clay
CL	lean clay
CLSM	controlled low strength material
CVFPB	Central Valley Flood Protection Board
CVFPP	Central Valley Flood Protection Plan
CWA	Clean Water Act
DBH	diameter at breast height
DSM	deep soil mixing
DWR	Department of Water Resources
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESAs	Environmentally Sensitive Areas
feasibility study	Sutter Basin Pilot Feasibility Study
FR	Federal Register
FRWLP	Feather River West Levee Project
GGs	giant garter snake
GPS	global positioning system
ICF	ICF International
LAE	Land Acquisition Evaluations
LD1	Levee District 1
LL	Liquid Limit
ML	silt
MMP	mitigation and monitoring proposal
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OHWM	ordinary high water mark
PI	Plasticity Index

RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SBFCA	Sutter Butte Flood Control Agency
SC	clayey sand
SM	silty sand
SPCCP	spill prevention, control, and counter-measure plan
SR	State Route
SWPPP	stormwater pollution prevention plan
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VELB	valley elderberry longhorn beetle

Chapter 1

Responsible Parties

This document describes the mitigation and monitoring plan (MMP) for effects associated with implementation of the Sutter Basin Pilot Feasibility Study (feasibility study). Implementation of flood risk reduction projects outlined in the feasibility study will create permanent and unavoidable impacts to habitats and species that require mitigation. This document identifies responsible parties for the mitigation project, describes the location and nature of the project, and discusses the types, functions, and values of United States Army Corps of Engineers (USACE) jurisdictional wetlands and other waters of the United States.

In addition to the mitigation plan for impacted Section 404 jurisdictional features, this MMP also includes impacts and mitigation for riparian and non-riparian native trees, and special status species habitat for valley elderberry longhorn beetle (VELB) and permanent impacts to giant garter snake (GGS), for which compensatory mitigation is required.

Compensatory mitigation for riparian forest, non-riparian native trees and VELB will occur at the Star Bend Conservation Area and the TRLIA Feather River Floodway Corridor Restoration Site, both located on the Feather River. Mitigation for GGS and Section 404 jurisdictional features will occur at off-site private banking lands.

1.1 Mitigation Planning Guidance

As part of the feasibility study, a MMP was developed based on the following USACE and State guidance and the recommendations of the USFWS and other resource agencies.

1.1.1 USACE Mitigation Planning Guidance

In accordance with Council on Environmental Quality (CEQ) Regulations for Implementing NEPA (40 CFR 1500-1508), and with Appendix C, paragraph C-3 of ER 1105-2-100, "Policy and Planning Guidance for Conducting Civil Works Planning Studies (Planning Guidance Notebook)", the planning of USACE projects must ensure that project-related adverse environmental impacts (i.e., impacts to fish and wildlife resources) have been avoided or minimized to the extent practicable, and that remaining unavoidable significant adverse impacts are compensated to the extent justified. Corps regulations stipulate that the Recommended Plan must contain sufficient mitigation measures to ensure that the plan selected will have no more than negligible net adverse impacts on fish and wildlife resources. Furthermore, a Cost Effectiveness Incremental Cost Analysis must be performed to identify the most cost-effective mitigation plan.

Under WRDA 2007, Section 2036(a), the Corps must fully develop a mitigation plan that includes the following: 1) monitoring until successful, 2) criteria for determining ecological success, 3) a description of available lands for mitigation and the basis for the determination of availability, 4) the development of contingency plans (i.e., adaptive management), 5) identification of the entity responsible for monitoring; and 6) establishing a consultation process with appropriate Federal and State agencies in determining the success of mitigation.

The pilot study initiative of risk-informed decision making was applied in developing a justified and cost effective mitigation plan. Consistency in approaches between the feasibility study and the 408 Feather River West Levee Project in the development of mitigation plans was a goal to ensure consistency of decisions and communication with the resources agencies. Early on a decision was made to use acreage and habitat significance instead of habitat based modeling such as USFWS habitat evaluation procedures (HEP) due to a number of considerations. The USFWS concurred with a non-HEP approach to impact and mitigation assessment. The cost of mitigation and the impacts to fish and wildlife habitats are relatively small relative the project footprint and overall cost of the project. Proposed fix-in-place levee improvements have generally minimize impacts to the existing levee structure.

A more rigorous more detailed CE/ICA analysis would be unlikely to result in a more cost effective plan. A comparison between mitigation banks and project proposed mitigation showed significant differences in cost depending on habitat type. Compensation requirements prescribed by NMFS and USFWS for effects to listed species amount to about half of the cost of mitigation plan. Mitigation plans achieving less than full compensation for effects to listed species would likely be unacceptable to the USFWS and NMFS and increase the potential for jeopardy determinations from these agencies and risk project delays. The risk to project cost is low because mitigation costs are relatively minor compared to overall project costs and mitigation costs are more likely to go down with consideration of an ETL variance by the project to further minimize loss of riparian habitat.

1.1.2 California Department of Fish and Wildlife Compliance

This document follows the format and contains the elements described in USACE report *Mitigation and Monitoring Proposal Guidelines, December 30, 2004* (USACE 2004). Because this report also includes mitigation for non-Section 404 jurisdictional features and will utilize land at the Star Bend Conservation Area, the document also complies with the California Department of Fish and Wildlife's (CDFW) own guidelines outlined in *Policy for Mitigation on Publicly Owned, Department Owned, and Conserved Lands* (CDFW 2012). The policy statement contained within the CDFW's report states:

Mitigation for impacts to fish and wildlife resources may occur on publicly owned, Department owned, and conserved lands if it has been determined by the Department that: 1) the mitigation is consistent with requirements of the law under which the mitigation is being sought; 2) its relative value as mitigation is equal to or greater than it would be if the same mitigation were situated on non-public or non-conserved lands; 3) it results in a clear and quantifiable improvement or positive change above that currently present or reasonably expected to exist under current conditions on the site; 4) the future uses of the land, including encumbrances or easements, will not preclude or diminish the mitigation; 5) the mitigation will not preclude, diminish or interfere with the funding or purpose of acquisition, encumbrances, or management plan for the property; and 6) it will not result in a net loss of existing conservation values.

CDFW Guidelines for Implementing Mitigation on Department Owned or Conserved Lands

The following guidelines are addressed throughout the MMP below. Items 1 through 4 have been fully addressed in this MMP. Item 5 is addressed in the project's incremental cost analysis. The Memorandum of Understanding described in item 6 below is still a work in progress and will be finalized before the MMP is complete.

1. Mitigation is consistent with the current and future uses of the land including any encumbrances, easements or public use values.
 - a. To find information on encumbrances, easements or public use values the following documents should be checked:
 - i. Management plan for the property
 - ii. Any Conceptual Area Protection Plans (CAPP) or Land Acquisition Evaluations (LAE) written for the property
 - iii. Easements can be found on the California Natural Resources Agency website and at the County Recorders office. The Lands Program should also be checked.
 - iv. Title search – this should be performed by the entity proposing the mitigation
 - v. Site visits should be performed
2. Mitigation is consistent with the purpose for which the land was acquired and the funding source used for acquisition.
3. Mitigation will not preclude, diminish or interfere with encumbrances, or the management plan for the property.
4. Mitigation maintains and or enhances the current ecological and public use values of the land.
 - a. Entity proposing the mitigation needs to provide documentation of how placing the mitigation on the land is going to maintain or enhance the ecological and public use values of the land.
5. The full cost of the mitigation is accounted for (this includes but is not limited to all capital improvements, restoration, enhancement, monitoring, long term management and maintenance and reimbursement for any Department staff time including enforcement, on all lands).
6. A Memorandum of Understanding (MOU) is in place prior to the project sponsors undertaking the project. The MOU will be developed in cooperation with the land manager, reviewed for statewide consistency by the Department's Lands Program in the Wildlife Branch and signed by the District Assistant Chief and the Department Regional Manager, the land management agency or non-profit (if other than the Department), and the project sponsor. The MOU will define the mitigation purpose, permit requirements, agreement term, scope of work, schedule, management and/or maintenance requirements, monitoring, and responsibilities of the parties to the agreement.

1.2 Lead Agency

USACE is the lead agency and implementing agency for the feasibility study. USACE is preparing the Environmental Impact Statement (EIS) for the purposes of compliance with the National Environmental Policy Act (NEPA). USACE is also completing Section 7 Endangered Species Act consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) for the project. USACE is the lead Federal agency with financial responsibility for implementing the MMP and satisfying the success criteria.

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2.1 Project Location

North to south, the feasibility study area is located in the 41-mile corridor along the west levee of the Feather River that begins at the Thermalito Afterbay and ends approximately 4 miles north of the Sutter Bypass (Figure 1). The project area consists of the project construction footprint plus a 100-foot-wide buffer zone. The feasibility project construction area was defined as the area in which levee improvements—such as seepage berms, stability berms, relief wells, and slurry cutoff walls—are likely to be constructed. All direct and indirect effects would occur within the project area.

The feasibility study area corridor is divided into 41 relatively reaches for ease of describing existing conditions, project components, land cover types, and potential effects (note that this number is coincidental and one reach does not correspond to a length of 1 mile). The levee stations, lengths, landmarks, and dominant land uses for the reaches are listed in Table 2-1. Table 2-1

Table 2-1. Summary of Reaches in the Feasibility Study Area

Reach	Beginning Station	Ending Station	Length (feet)	Landmark(s)	Dominant Land Uses
1	189+00	202+50	2,250	Laurel Avenue	
2	202+50	218+66	1,616		Ruderal grassland; open space
3	218+66	300+66	8,200	Cypress Avenue	Ruderal grassland; open space
4	300+66	410+67	11,001	Central Street; Wilkie Avenue	Orchard; ruderal grassland; riparian forest
5	410+67	478+68	6,801	Wilkie Avenue	Orchard
6	478+68	510+37	3,169	Star Bend	Orchard
7	510+37	596+00	8,563	Abbott Lake	Ruderal grassland; open space
8	596+00	654+75	5,875		Ruderal grassland; open space
9	654+75	706+50	5,175	Boyd's Boat Launch; Nursery	Ruderal grassland; open space
10	706+50	774+00	6,750	Barry Road	Ruderal grassland; open space
11	774+00	830+00	5,600		Ruderal grassland; open space
12	830+00	845+00	1,500	Shanghai Bend	Ruderal grassland; open space
13	845+00	927+00	8,200		Ruderal grassland; open space
14	927+00	954+40	2,740	Airport	Ruderal grassland; open space
15	954+40	968+50	1,410	Airport	Developed; ruderal grassland
16	968+50	1080+00	11,150	Garden Highway, 2nd Street; Twin Cities Memorial Bridge; Colusa Avenue	Developed; ruderal grassland
17	1080+00	1130+86	5,086	Live Oak Boulevard; Union Pacific Railroad	Developed; ruderal grassland
18	1130+86	1213+85	8,299	Live Oak Boulevard; Union Pacific Railroad; Rednall Road	Orchard
19	1213+85	1297+83	8,398		Orchard
20	1297+83	1374+33	7,650		Orchard; ruderal grassland
21	1374+33	1433+83	5,950		Ruderal grassland
22	1433+83	1503+83	7,000		Riparian forest; ruderal grassland
23	1503+83	1609+37	10,554		Orchard
24	1609+37	1623+86	1,449		Riparian forest; ruderal grassland
25	1623+86	1674+37	5,051		Orchard; ruderal grassland
26	1674+37	1707+11	3,274		Orchard
27	1707+11	1721+60	1,449		Ruderal grassland
28	1721+60	1769+31	4,771		Orchard
29	1769+31	1813+33	4,402		Orchard; riparian forest
30	1813+33	1902+00	8,867		Orchard
31	1902+00	1958+00	5,600		Orchard; ruderal grassland
32	1958+00	1989+00	3,100		Orchard
33	1989+00	2122+00	13,300		Orchard
34	2122+00	2182+00	6,000		Orchard
35	2182+00	2224+00	4,200		Orchard; ruderal grassland
36	2224+00	2259+00	3,500		Orchard; ruderal grassland
37	2259+00	2290+00	3,100		Orchard; ruderal grassland
38	2290+00	2303+00	1,300		Ruderal grassland
39	2303+00	2319+00	1,600		Ruderal grassland
40	2319+00	2359+00	4,000		Ruderal grassland
41	2359+00	2368+00	900	Thermalito Afterbay	Ruderal grassland

Note: Certain planning and engineering studies for the feasibility study area make reference to segments within the planning area under which the reaches above are grouped. These segment designations do not have substantial bearing on the alternatives descriptions, environmental setting, or determination of effects and thus for simplicity are not used in this document.

The new study paradigm recognizes that no single factor, including net national economic development benefit, should provide the basis for the USACE decision for a recommendation for Federal investment. Alternative comparison and selection recognizes that there is no single “best” plan, and there are a variety of approaches (quantitative and qualitative) to multi-criteria decision making.

2.1.1 Project Purpose and Need

The purpose of the Sutter Basin Pilot Feasibility Study is to investigate and determine the extent of Federal interest in plans that reduce flood risk to the Sutter Basin in Sutter and Butte Counties. This report: (1) assesses the risk of flooding; (2) describes a range of alternatives formulated to reduce flood risk; and (3) identifies a recommended plan for implementation. This report constitutes both a draft Feasibility Report that describes a USACE “pilot” planning process followed to identify the recommended plan, and an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) required to comply with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Following public and governmental agency review, this draft report will be finalized and submitted to Headquarters, USACE, for review and approval, then transmitted to Congress for recommended project authorization. Project construction would also be dependent upon Congressional appropriation of funding for the Federal share of the project.

A high risk of flooding from levee failure threatens the public safety of approximately 95,000 people, as well as property and critical infrastructure throughout the Sutter Basin study area. Past flooding events have caused loss of life and extensive economic damages. Recent geotechnical analysis and evaluation of past levee performance indicate the existing project levees, which are part of the authorized Sacramento River Flood Control Project, do not meet current U.S. Army Corps of Engineers (USACE) levee design criteria, and are at risk of breach failure at stages less than overtopping of the levees, as has been shown to be true of many of the existing levees within California’s Central Valley.

2.1.2 Federal Objectives

In the Flood Control Act of 1970, Congress identified four equal national objectives for use in water resources development planning. These objectives are national economic development (NED), regional economic development (RED), environmental equality (EQ), and social well being (other social effects or OSE). These four categories are known as the System of Accounts, whereby each proposed plan can be easily compared with the no-action plan and other alternatives. The Federal objective identified in the P&G is:

“The Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the Nation’s environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.”

In Section 2031 of Water Resources Development Act of 2007, Congress instructed the Secretary of the Army to develop a new P&G for USACE (Public Law 110-114). As a result, the P&G is being revised to include a number of important changes. These changes are expressed in the following proposed new Federal objectives statement:

“The national objective of water and related land resources planning is to foster environmentally sound, efficient use of the Nation’s resources consistent with public safety. This can be accomplished through watershed analyses that recognize the interdependency of water uses. This is strengthened by capitalizing on a collaborative planning and implementation process which incorporates fully

informed participation from Federal agencies, non-Federal interests, non-governmental organizations, State and local and Tribal governments, and a full range of water users and stakeholders.”

“Water and related land resources planning that is consistent with the national planning objective seeks to incorporate some or all of these elements: facilitate sustainable national economic development, encourage wise use of water and related land resources – including flood plains, and flood-prone coastal areas, support the protection and restoration of significant aquatic ecosystems, promote the integration and improvement of how the Nation’s water resources are managed; and reduce vulnerabilities and losses due to natural disasters.”

The Federal objective is not specific enough for the development of a water resource project. The formulation of alternative plans requires the identification of study-specific planning objectives.

2.1.3 Non-Federal Objectives

The State of California, recognizing the continuing risk of flooding within the Central Valley, has enacted the Central Valley Flood Protection Act (CVFPA) and related legislation that establishes in California law the objective of providing 200-year (1/200 or 0.5% annual exceedance probability) protection to urban and urbanizing areas. Additionally, the CVFPA requires an immediate analysis of the condition of the system levees, an action plan for achieving the desired level of protection, and associated actions to reduce residual risks to development within the protected area.

In addition to complying with the state requirement, the non-Federal sponsors seek to reduce residual risk to the rural south portion of the Sutter Basin for sustainable high-value agricultural operations.

2.1.4 Planning Objectives

Planning objectives for the SBPFS are more specific than the Federal and non-Federal objectives and reflect the problems and opportunities in the study area; an objective is developed to address each of the identified problems and opportunities. Planning objectives represent desired positive changes to the future without-project conditions. All of the objectives focus on activity within the study area and within the 50-year period of analysis.

The planning objectives are:

- Reduce the risk to life, health, public safety and critical infrastructure due to flooding.
- Reduce the risk of property damage due to flooding.
- In conjunction with FRM, improve ecosystem functions and values.
- In conjunction with FRM, improve the public’s access to and use of outdoor recreational opportunities in the study area.

As discussed above, it is anticipated the construction of the project would be divided into six separate construction contracts (i.e., A, B, C-1, C-2, D-1 and D-2). Although subject to change, the most current information for the six contracts and their respective areas is provided in Table 2-2.

Table 2-2. Feasibility Study Proposed Construction by Contract, Reach, and Year of Construction

Contract	A	*Star Bend	B	C1	C2	D1	D2
Corresponding Reach	2–5	6	7–12	13–18	19–25	26–33	34–41
Proposed Year of Construction	2018– 2019	2018– 2019	2017– 2018	2013– 2014	2014– 2015	2015– 2016	2016– 2017

* Included as part of Contract A analysis.

2.1.5 Project Description

The two construction alternatives analyzed in detail through the NEPA process would each accomplish the identified project purpose. However, they would accomplish the project purpose to varying extents, with varying levels of benefits and varying adverse impacts to the aquatic ecosystem.

The following is a summary of project elements for each alternative. In general, Alternative SB-8 entails the greatest amount of levee improvement work and SB-7 the least amount. These alternatives are described in greater detail in Chapter 3 of the integrated report and EIS/EIR.

Alternative SB-8 includes:

41 reaches (2A-North to 41) along the FRWL alignment, beginning at station 180+00 (approximately 2,500 feet south of Laurel Avenue) and ending at station 2368+00 (Thermalito Afterbay). The proposed project features and measures for this alternative include:

- Soil-Bentonite Cutoff Walls
- Deep Soil Mix Cutoff Walls
- Jet Grouting Cutoff Walls
- Seepage Berms
- Levee Relocations
- Canal Relocations
- Embankment Reconstruction/Landside Toe Fill
- Erosion Protections
- Closure Structure
- Utility Improvements
- Utility Relocations
- Structural Relocations

These proposed features and measures will rehabilitate, replace, or tie in and function in junction with the existing system. The existing system includes the following features:

- Existing Embankment
- Existing Cutoff Walls

- Existing Stability Berms
- Existing Relief Wells
- Existing Closure Structures
- Existing Toe Drains

Table 2-3 identifies the construction activities that would occur with each reach.

Table 2-3. SBFS Flood Management Measures by Reach

Reach	Length (feet)	Proposed Action Flood Management Measure
2A	2,250	180+00 to 202+50, 100 ft. wide undrained seepage berm. Seepage berm 5 ft. thick at berm toe. 180+00 to 202+50, Cutoff wall extending to an elevation of 25 ft.
2B	1,616	202+50 to 218+66, cutoff wall extending to an elevation of 25' with 100'-wide undrained seepage berm. Seepage berm 5' thick at berm toe.
3	8,200	218+66 to 230+00, cutoff wall extending to an elevation of 25' with 100'-wide undrained seepage berm. Seepage berm 5' thick at berm toe. 230+00 to 250+00, cutoff wall tip elevation (-)35'. 250+00 to 289+00, cutoff wall tip elevation (-)20'. 289+00 to 300+66, cutoff wall tip elevation (-)12'.
4	11,001	300+66 to 312+00 cutoff wall tip elevation 15'. 312+00 to 349+00 cutoff wall tip elevation 15'. 349+00 to 368+00 cutoff wall tip elevation 10'. 368+00 to 410+67 cutoff wall tip elevation 20'.
5	6,801	410+67 to 417+00, cutoff wall tip elevation 20'. 417+00 to 425+00, cutoff wall tip elevation 10'. 425+00 to 456+00, cutoff wall tip elevation 15'. 456+00 to 475+35, cutoff wall tip elevation 15' with 300' wide undrained seepage berm. Seepage berm 5' thick at berm toe. 475+35 to 478+68 cutoff wall tip elevation 15'.
6	3,169	478+68 to 510+00, No Proposed Flood Management Measures 510+00 to 510+50, potential pipe crossing work to install positive closure device and correct pipe size.
7	8,563	510+37 to 512+00, no flood management required. 512+00 to 514+00, cutoff wall 514+00 to 526+00, cutoff wall tip elevation 15'. 526+00 to 570+00, cutoff wall tip elevation (-)5'. 545+00 to 570+00, relief wells with 60' spacing and 50' depth over one half of the length, distributed at various locations over this stretch of levee. 570+00 to 575+00, cutoff wall tip elevation 5'. 575+00 to 595+00, cutoff wall tip elevation (-)10'. 595+00 to 596+00, cutoff wall tip elevation 15'.

Reach	Length (feet)	Proposed Action Flood Management Measure
8	5,875	596+00 to 654+75, cutoff wall tip elevation 15'.
9	5,175	654+75 to 670+00, cutoff wall tip elevation 15'. 670+00 to 697+00, cutoff wall tip elevation 20'. 697+00 to 706+50: cutoff wall tip elevation 10'.
10	6,750	706+50 to 726+00, cutoff wall tip elevation (-)10'. 726+00 to 746+00, cutoff wall tip elevation (-)5'. 746+00 to 754+50, cutoff wall tip elevation 5'. 754+50 to 774+00, cutoff wall tip elevation 25'
11	5,600	774+00 to 784+50, cutoff wall tip elevation 25'. 784+50 to 827+50, cutoff wall tip elevation 5'. 827+50 to 830+00, cutoff wall tip elevation 25'
12	1,500	832+30, relocate two 24-inch sewer pipes.
13	8,200	844+50 to 923+75: cutoff wall tip elevation (-)38'. Full levee degrade from 844+50 to 897+50.
14	2,740	952+00 investigation of 12 kV cable to determine if it meets Title 23 requirements.
15	1,410	No flood management measures required.
16	11,150	Closure of gap in cutoff wall at 5th Street bridge crossing around Station 1007+00, cutoff wall tip elevation 40'. Closure of gap in cutoff wall at 10th Street bridge crossing around Station 1026+00, by using a seepage berm within the abandoned railroad tunnel. 1077+85 to 1080+00, cutoff wall tip elevation 30' and backfill landside toe depression. Miscellaneous landside encroachment relocations/removals.
17	5,086	1080+00 to 1089+00, cutoff wall tip elevation 30' and backfill landside toe depression. 1089+00 to 1125+00, cutoff wall tip elevation 35' and backfill landside toe depression. 1125+00 to 1130+86, cutoff wall tip elevation 0'.
18	8,299	1130+86 to 1151+50, cutoff wall tip elevation 0'. 1151+50 to 1159+50: cutoff wall tip elevation 30'. 1159+50 to 1169+50: cutoff wall tip elevation 25'. 1169+50 to 1189+50: cutoff wall tip elevation 30'. 1189+50 to 1209+50: cutoff wall tip elevation 40'. 1209+50 to 1213+85: cutoff wall tip elevation 35'.
19	8,398	1213+85 to 1219+75, cutoff wall tip elevation 35'. 1219+75 to 1224+00, cutoff wall tip elevation 5'. 1224+00 to 1238+00, cutoff wall tip elevation (-)28'. 1238+00 to 1248+00, cutoff wall tip elevation (-)42'. 1248+00 to 1268+75, cutoff wall tip elevation 3'. 1268+75 to 1297+83, cutoff wall tip elevation 35'.

Reach	Length (feet)	Proposed Action Flood Management Measure
20	7,650	1297+83 to 1298+75, cutoff wall tip elevation 35'. 1298+75 to 1359+00, cutoff wall tip elevation 50'. 1359+00 to 1369+00: cutoff wall tip elevation 40'. 1369+00 to 1374+33: cutoff wall tip elevation 32'.
21	5,950	1374+33 to 1386+00 cutoff wall tip elevation 32'. 1386+00 to 1408+00: cutoff wall tip elevation 55'. 1408+00 to 1432+50: cutoff wall tip elevation 40'. 1432+50 to 1433+83: Levee relocation (20 ft riverward, transition only) 1429+00 to 1433+83 Sutter Butte Main Canal relocation.
22	7,000	1433+83 to 1450+00: Levee relocation (20ft riverward) 1451+50 to 1451+50: Levee relocation (20ft riverward, transition only) 1451+50 to 1468+83, cutoff wall tip elevation 50'. 1455+00 to 1461+00, full levee degrade and reconstruction. 1468+83 to 1503+83, cutoff wall tip elevation 55'.
23	10,554	1503+83 to 1508+50, cutoff wall tip elevation 55'. 1508+50 to 1528+75, cutoff wall tip elevation 60'. 1528+75 to 1566+50, cutoff wall tip elevation 55'. 1566+50 to 1608+75, cutoff wall tip elevation 60'. 1608+50 to 1609+37: Levee relocation (20ft riverward, transition only)
24	1,449	1609+37 to 1612+00: Levee relocation (20ft riverward, transition only) 1612+00 to 1623+00: Levee relocation (20ft riverward) 1623+00 to 1623+86: Levee relocation (20ft riverward, transition only)
25	5,051	1623+86 to 1624+50: Levee relocation (20ft riverward, transition only) 1673+00 to 1674+37: Levee relocation (20ft riverward, transition only) 1639+00, replace two 24-inch steel storm drain pipes.
26	3,274	1674+37 to 1675+00: Levee relocation (20ft riverward, transition only) 1675+00 to 1707+11: Levee relocation (20ft riverward) Reconstruction of landside slope extends down to elevation of bottom of canal.
27	1,449	1707+11 to 1721+60: Levee relocation (20ft riverward)
28	4,771	1721+60 to 1753+00: Levee relocation (20ft riverward) 1753+00 to 1754+50: Levee relocation (20ft riverward, transition only) 1752+00 to 1766+00: Sutter Butte Main Canal Relocation 1766+00 to 1769+31, cutoff wall tip elevation 45'.
29	4,402	1770+00, 1785+24, 1785+55, 1792+96, 1799+44, 1809+65, storm drain and irrigation pipe replacements.
30	8,867	1813+33 to 1816+50, cutoff wall tip elevation 80', with full levee degrade and reconstruction. 1816+50 to 1848+25, cutoff wall tip elevation 30'. 1848+25 to 1866+00, cutoff wall tip elevation 70'. 1866+00 to 1877+75, cutoff wall tip elevation 47'. 1877+75 to 1883+00, cutoff wall tip elevation 40'. 1883+00 to 1902+00, cutoff wall tip elevation 27'.

Reach	Length (feet)	Proposed Action Flood Management Measure
31	5,600	1902+00 to 1907+50, cutoff wall tip elevation 27'. 1907+50 to 1917+50, cutoff wall tip elevation 44'. 1907+92 to 1909+42, waterside slope flattening or other remedial measure. 1917+50 to 1927+50, cutoff wall tip elevation 75'. 1927+50 to 1937+00, cutoff wall tip elevation 50'. 1937+00 to 1958+00, cutoff wall tip elevation 40'.
32	3,100	1958+00 to 1971+80, cutoff wall tip elevation 40'. 1971+80 to 1987+25, cutoff wall tip elevation 48'. 1987+25 to 1989+00, cutoff wall tip elevation 10'.
33	13,300	1989+00 to 2002+00, cutoff wall tip elevation 10'. 2002+00 to 2016+75, cutoff wall tip elevation 90'. 2016+75 to 2036+75, cutoff wall tip elevation 20'. 2036+75 to 2041+00, cutoff wall tip elevation 53'. 2041+00 to 2067+00, cutoff wall tip elevation 38'. 2067+00 to 2088+00, cutoff wall tip elevation 33'. 2088+00 to 2122+00, cutoff wall tip elevation 90'.
34	6,000	2122+00 to 2137+00, cutoff wall tip elevation 90'. 2137+00 to 2148+00, cutoff wall tip elevation 20'. 2148+00 to 2164+00, cutoff wall tip elevation 90'. 2164+00 to 2182+00, cutoff wall tip elevation 50'.
35	4,200	2182+00 to 2196+50, cutoff wall tip elevation 40'. 2196+50 to 2212+00, cutoff wall tip elevation 45'. 2212+00 to 2218+25, cutoff wall tip elevation 50'. 2218+25 to 2224+00, cutoff wall tip elevation 55'.
36	3,500	2224+00 to 2233+50, cutoff wall tip elevation 55'. 2233+50 to 2245+75, cutoff wall tip elevation 70'. 2245+75 to 2259+00, cutoff wall tip elevation 42'.
37	3,100	2259+00 to 2277+00, cutoff wall tip elevation 42'. 2277+00 to 2290+00, cutoff wall tip elevation 45'.
38	1,300	2290+00 to 2292+00 cutoff wall to elevation +45'. 2290+00 to 2303+00 construct 11' high seepage berm, 50' wide at the top and 170' wide from levee centerline.
39	1,600	2312+10, remove 24" storm drain pipe.
40	4,000	2331+00 to 2335+00, construct 120'-wide seepage berm. 2335+00 to 2359+00, 100'-wide seepage berm. Berms are 9' thick at the levee toe and 3' thick at the berm toe.
41	900	2359+00 to 2368+00, construct 100'-wide seepage berm with 1'-thick drain layer. 2360+00; fill waterside pit (up to elevation 130').

Encroachments

Existing facilities found within the footprint of an alternative may require removal and replacement nearby, abandonment, or relocation. Encroachments are numerous (over 400 identified) along the Feather River West Levee and may need to be addressed if they present a threat to the stability of the levee, do not currently comply with the levee encroachment criteria, or would be disrupted or otherwise impacted by construction activities. Typical encroachments include pressure pipelines (water supply pipelines from waterside pump stations and drainage pipelines from landside drainage pump stations), gravity drainage pipes, gas lines, telephone utilities, overhead utilities, structural encroachments, and other types and variations. Debris from structure and embankment fill material of poor quality would be hauled offsite to a permitted disposal site within 20 miles of the removal location.

Vegetation Removal

Bulldozers would be used to remove woody and herbaceous vegetation from the direct construction footprint and the minimum areas needed for project staging and access routes. Any vegetation removed as part of direct construction activities would not be replaced at that location and would require offsite, in-kind mitigation, to be determined in consultation with the appropriate resource agencies.

More extensive root removal may be required, depending upon the location, size, and type of tree; the quantity, orientation, and size of the roots; the dimensions of the levee (or floodwall); the composition of the levee and foundation; and the levee features that address seepage and underseepage. Less extensive root removal may be justified where roots from adjacent trees would be unduly damaged. Any excavation resulting from the above actions would be backfilled with engineered fill using appropriate placement, moisture conditioning, and compaction methods. Additional measures for removing non-compliant vegetation are listed below.

- Ensure that the resulting void is free of organic debris.
- Cut poles to salvage propagation materials for replanting, such as willows and cottonwoods.
- Conduct hand clearing using chainsaws and trimmers.
- Conduct mass clearing using bulldozers.

Debris from vegetation removal would be hauled offsite to a permitted disposal site within 20 miles of the removal location.

Construction Staging, Access, and Temporary Facilities

The contractor would be responsible for obtaining all required local, state, and Federal permits for any staging areas outside of these limits. Staging areas would be used for equipment staging, storage of equipment and materials, mobile project offices, construction staff parking, etc.

To facilitate project construction, temporary earthen ramps would be constructed for equipment access between the levee crown and the staging area(s). The earthen ramps would be removed when construction is complete.

Cutoff wall construction requires temporary establishment of an onsite slurry batch plant that would occupy approximately 1–2 acres. Batch plants would be located at approximately 1-mile

intervals within the project footprint. The batch plant site would likely contain tanks for water storage, bulk bag supplies of bentonite, bentonite storage silos, a cyclone mixer, pumps, and two generators that meet air quality requirements. The site would also accommodate slurry tanks to store the blended slurries temporarily until they are pumped to the work sites. Slurry ingredients would be mixed with water at the batch plant and the mixture would be pumped from the tanks through pipes to the cutoff wall construction work sites. The batch plant would produce two different slurry mixes, one for trench stabilization and one for the soil backfill mix. Therefore, two slurry pipes or hoses, typically 4- or 6-inch high-density polyethylene pipes, would be laid on the ground and would extend to all work sites. An additional pipe may be used to supply water to the work sites.

Staging areas, access routes, and other temporary construction areas would be located away from wetlands, riparian habitat, oak woodlands, special-status wildlife habitat, known cultural resources, or other sensitive areas and would be limited to disturbed or ruderal grasslands subject to review by USACE and Federal and state resource agencies.

Material Importation, Reuse, and Borrow

Materials imported to the project site would include water, bentonite, cement, incidental construction support materials, aggregate base rock, asphalt, concrete, hydroseed, and embankment fill soil. Each alternative would require the use of large quantities of fill soil, or borrow. To meet borrow demands, embankment fill material excavated as part of construction would be evaluated for reuse. Embankment fill material deemed suitable would be used as part of levee reconstruction and berms.

Borrow Volume

The total volume of material required is 1,619,250 cubic yards. The quantities were calculated assuming a 20% shrinkage factor between excavation at the borrow site and placement at the levee. Only material suitable for placement in levee construction may be borrowed (HDR et al. 2012). These materials are identified as low to medium plasticity soils classified in accordance with American Society for Testing and Materials D 2487 as silty sand (SM) and clayey sand (SC), silt (ML), or clay (lean clay [CL] or fat clay [CH]). The materials should have a Liquid Limit (LL) less than or equal to 45 (may be extended up to 55 with justification and approval from USACE and the CVFPB), a Plasticity Index (PI) greater than or equal to 12 and less than 40, and a fines content greater than or equal to 30%. The material should be free from visible organics and be no greater than 2 inches in any dimension.

Borrow Site Selection Factors

The first choice for fill or borrow material would be from a local commercial quarry or other permitted source. In the event that material is desired from a source that is not presently permitted, for reasons such as quality, proximity, or volume available, soil supply protection measures would be implemented. One such measure would be maximizing on-site use through gradation, placement, and treatment. Another measure would be the preservation and replacements of topsoil at borrow sites, so that they could be continued to be used for their current use or otherwise returned to their pre-project condition. As part of borrow operations, the upper 12 inches of topsoil would be set aside and replaced after project construction in each construction season. After the project is

completed, the borrow site would be re-contoured and reclaimed. An additional measure would be independent environmental documentation and regulatory compliance, as required.

Factors determining borrow sources and sites are (followed by a description of each factor and discussion of potential borrow sources).

- Hauling distance and haul route
- Depth to groundwater
- Royalty fees
- Post-construction land use
- Environmental factors

Hauling Distance and Routes. The cost for borrow site excavation and hauling is directly related to the distance required to haul the material and the route by which the materials must be transported. To the extent possible, sites should be selected that minimize haul route length and the use of public roadways (Wood Rodgers 2011).

Depth to Groundwater. Because the top layer of a borrow site must be removed and stockpiled to exclude organics from the borrow material, it is economical to maximize the depth of the excavation. This maximum depth is typically governed by the normal seasonal depth of groundwater. Once excavation extends to within a few feet of the groundwater table, additional expense is incurred to implement dewatering at the site. Groundwater elevations generally fluctuate throughout the year and can be influenced by standing water or irrigation activities on adjacent lands. Typically, groundwater depths are higher at the beginning of spring, and become deeper toward the end of summer (Wood Rodgers 2011).

Royalty Fees. Royalty fees for material excavated directly affect the cost of the borrow and also typically trigger more substantial permitting requirements. It is desirable to find a property owner who wishes to have excavation carried out for his own purposes, such as creating a detention basin to support future development, so that royalty fees and a SMARA permit are avoided (Wood Rodgers 2011).

Post-Construction Land Use. The post-construction use of the property can also effect the depth of excavation. Borrow sites must be free draining after the material is excavated, and therefore cannot be extended deeper than the offsite drainage facilities can accommodate (Wood Rodgers 2011).

Environmental Factors. Environmental factors, including the need for mitigation for special-status species and wetlands encroachments, are also a factor in selecting borrow sites. Consideration should also be given to haul routes when evaluating environmental effects. Routes which could be unavailable during the early months of the construction season due to the presence of nesting raptors should be avoided (Wood Rodgers 2011). If waterside borrow sites outside the construction footprint are needed, only sites that do not impact woody vegetation associated with fish-inhabited waters should be considered. All sites will be surveyed for potential wildlife habitat, jurisdictional waters, cultural resources, and other environmental regulatory triggers prior to use, and environmental documentation and permits will be secured independently or supplemental to the project documentation and permits.

Borrow Sources and Proposed Borrow Sites

Fill or borrow material may be purchased from a local commercial quarry or other permitted source; however, there are not currently any sites near the project area that would supply the volume and type of material required. Consequently, the most likely possibility is for fill to be purchased from local landowners willing to sell borrow material.

Five borrow sites have been identified in the project area. Each site was investigated to determine the quantity of available material, hauling distance, material composition, groundwater elevation, and prospects for acquisition. The purpose of the investigation was to identify the sites with the greatest potential to economically provide material for the project. Economical hauling has been determined to be within a 2-miles radius and marginally economic hauling within a 10-mile radius. As a result of the borrow analysis, sufficient fill volume is present within an approximate 10-mile, one-way haul distance from the area of construction.

A potential borrow sites' utilization would be maximized through gradation, placement, and treatment so that they could continue to be used for their current use or otherwise returned to their pre-project condition. As part of borrow operations, the upper 4–6 inches of topsoil would be set aside and replaced after construction in each construction season. After the project is completed, the borrow site would be re-contoured and reclaimed.

Through outreach efforts, a number of sites owned by individuals or government agencies willing to sell their property or provide material on a cubic yard basis. Figure 1 shows the locations of the five potential borrow sites identified and the proposed haul routes to the construction area.

North Valley Property

The North Valley property is owned by North Valley Properties, LLC and is located south of Ella Road between Feather River Boulevard and Arboga Road. The Wheeler Ranch housing development is proposed at the site. Borrow for the project would be taken from the northeast corner of the property to create a 24.5 acre detention pond (referred to as referred to as the Drainage Basin C Regional Detention Pond but commonly referred to as the South Ella Detention Pond). The Ella Basin is being constructed as part of Reclamation District No. 784's Master Drainage Plan. Historically, the site was cultivated for agricultural purposes. Currently, the site is disked ruderal grassland with some roads cut in the southern portion of the property for the Wheeler Ranch development. The material at this site is anticipated to be CL from a depth of 18–22 feet, followed by silt-sand material below a depth of 22–25 feet. The depth of excavation is anticipated to be 15–20 feet and the yield of material from this site could be 400,000–500,000 cubic yards. Borrow material from this site would be used for work in Contract C-1 and C-2, and Contract B. If borrow material is remaining, it may also be used for Contract D-1 and D-2.

The haul route to the northern portion of Contract C from the North Valley Property would be west on Ella Avenue to north on Feather River Boulevard to north on SR70 to west on SR20/Colusa Avenue to north on Live Oak Boulevard to north on SR99 to east on Paseo Avenue. Additional access route to the levee along northbound SR99 would be north on Kent Avenue to east on Koch Lane. Additional access routes to the levee along northbound Live Oak Boulevard would be east on Morse Road, east on Rednall Road and east on Market Street to east on Lynn Way. Additional access routes to the levee along westerly SR20/Colusa Avenue would be North on Sutter Street/Market Street to east on Lynn Way.

The haul route to the southern portion of Contract C from the North Valley Property would be west on Ella Avenue to north on Feather River Boulevard to north on SR70 to west on SR20/Colusa Avenue to south on Sutter Street to south on 2nd Street to levee access. Additional access route to the levee along westerly SR20/Colusa Avenue would be south on SR99 to east on Bogue Road to south on Garden Highway to east on Shanghai Bend Road.

The post-project land use of the site would be a regional detention pond for Reclamation District No. 784.

Marler Property

The Marler property is a 10-acre property at Johnson Road near Messick Road north of Star Bend and south of Shanghai Bend. The site is currently an orchard. The depth of excavation could be upwards of 6 feet. The yield of material from this site could be up to 75,000 cubic yards. The likely haul route would be Johnson Road to Messick Road to the Garden Highway, accessing the levee near Oswald Road. The post-project land use for the property would be agricultural production, likely row crops or orchard.

Lanza Property

The Lanza property is 40 acres in size and is currently farmed in field/row crops. It is located at North Township Road and Pease Road south of Live Oak and north of Yuba City. The site has not yet been investigated to determine the types of materials present. Excavation of the site to a depth of 6 feet may occur. The yield of material from this site could be up to 200,000 cubic yards. The likely haul route would be along Pease Road directly east to the levee. The post-project land use for the property would be rice production.

City of Live Oak Detention Basin

The City of Live Oak owns the property formerly known as the Caltrans Detention Basin Site located west of SR 99 and south of Paseo Avenue. The site is currently fallow. The City of Live Oak intends to construct soccer fields and a stormwater detention basin at the site in 2013 or later. Although the site would require hauling for a short distance through a residential neighborhood, it is anticipated the residents would be amenable to the hauling as it would be a part of the public amenity constructed by the City of Live Oak. The material at this site is anticipated to be CL from a depth of 1–2.5 feet, followed by more sandy material to a depth of 6 feet. This site is approximately 25 acres, and the depth of excavation is anticipated to be 3–6 feet. The yield of material from this site could be up to 125,000 cubic yards, and would likely be used for Contract C. The haul route to the northern portion of Contract C from the City of Live Oak Detention Basin would be west crossing the canal to north to Treatment Plant Access road and west on Treatment Plant Access Road to north on Farm Access Road to north on Richards Avenue to east on Pennington Road. Additional access routes to the levee from eastbound on Pennington Road are south on SR99 to east on Paseo Avenue and north on Metteer Road to east on Riviera Road. Additional routes to the levee along northerly Metteer Road would be east on Campbell Road and east on Cooley Road.

The City of Live Oak (Schmidt, pers. comm.) reports that land at this location has historically been cultivated for agricultural purposes and that there was no evidence of any wetland or other sensitive plant or wildlife areas remaining onsite. A preliminary wetland delineation of the area conducted by HDR Engineering in December 2012 did not identify any wetland features. The previous agricultural use has displaced native species of plants and animals except those varieties capable of co-existing

with humans in urban settings. The post-project use of the site would be a community park and stormwater detention basin facility.

Oroville Wildlife Area Dredge Tailings Area

This site is within the Oroville Wildlife Area and consists of several mounds of dredge tailings on the waterside of the existing levee. The material is suitable for use in seepage berms at Reaches 40 and 41 and an adjacent levee at Reach 38. The availability of tailings in the area should be sufficient to meet the total deficit for berm material in these reaches. The excavation of the material would be coordinated to maximize hydraulic benefits from the reshaping of the overbank area. The site also represents an opportunity to provide waterside habitat enhancements. The useful area of this site could be approximately 75 acres and the depth of excavation could be upwards of 10 feet. The yield of material from this site could be up to 375,000 cubic yards. Hauling from this site would not take place on public roads. It is anticipated the contractor would use an existing waterside levee ramp (or create one), directly accessing the levee patrol road. The future land use for this site would be similar to its present day use (managed habitat area).

Post-Construction Operations and Maintenance

After construction completion, the levee and staging areas and levee slopes would be hydroseeded for erosion protection, dust abatement, and to prevent colonization of exotic vegetation.

In accordance with Federal Flood Control Regulations (33 CFR 208.10) and State requirements (California Water Code Section 8370), each year the Federal flood control facilities are inspected four times, at intervals not exceeding 90 days. DWR would inspect the system twice per year, and the local maintaining authorities would inspect it twice per year and immediately following major high water events. The findings of these inspections would be reported to the CVFPB's Chief Engineer through DWR's Flood Project Integrity and Inspection Branch.

Permanent facilities associated with relief wells include the wells themselves and surface drainage trenches to control the discharge. Inspection of the relief wells is required at least annually, and observation of flow from the wells is required during high river stages. The wells are test-pumped periodically. The collection ditch is maintained to allow free flow of water.

Because operations and maintenance activities are conducted by DWR and local flood protection districts, the effects of these activities are not part of the project and are not discussed further in this MMP.

2.1.6 Conservation Measures

The following conservation measures will be implemented during project construction to avoid and minimize effects on federally listed species.

General

Conservation Measure 1: Conduct Mandatory Biological Resources Awareness Training for All Project Personnel and Implement General Requirements

Before any ground-disturbing work (including vegetation clearing and grading) occurs in the project area, a biologist approved by USFWS, NMFS, and CDFW will conduct a mandatory biological

resources awareness training for all construction personnel about federally listed species that could potentially occur onsite (VELB, giant garter snake, and fish species). The training will include the natural history, representative photographs, and legal status of each federally listed species and avoidance and minimization measures to be implemented. Proof of personnel attendance will be provided to USFWS, NMFS, and CDFW within 1 week of the training. If new construction personnel are added to the project, the contractor will ensure that the new personnel receive the mandatory training before starting work. The subsequent training of personnel can include videotape of the initial training and/or the use of written materials rather than in-person training by a biologist. Requirements that will be followed by construction personnel are listed below.

- Where suitable habitat is present for listed species, the construction limits will be thoroughly delineated with survey tape, pin flags, orange barrier fencing, or other means, and prohibit any construction-related traffic outside these boundaries.
- Project-related vehicles will observe the posted speed limit on hard-surfaced roads and a 10-mile-per-hour speed limit on unpaved roads during travel in the project construction area.
- Project-related vehicles and construction equipment will restrict off-road travel to the designated construction areas.
- All food-related trash will be disposed of in closed containers and removed from the project construction area at least once per week during the construction period. Construction personnel will not feed or otherwise attract fish or wildlife to the project site.
- No pets or firearms will be allowed in the project construction area.
- To prevent possible resource damage from hazardous materials such as motor oil or gasoline, construction personnel will not service vehicles or construction equipment outside designated staging areas.
- Any worker who inadvertently injures or kills a federally listed species or finds one dead, injured, or entrapped will immediately report the incident to the biological monitor and construction foreman. The construction foreman will immediately notify the implementing agency, who will provide verbal notification to the USFWS Sacramento Endangered Species Office and/or the local CDFW warden or biologist within 1 working day. The implementing agency will follow up with written notification to USFWS or CDFW within 5 working days. The biological monitor will follow up with implementing agency to ensure that the wildlife agencies were notified.
- The biological monitor will record all observations of federally listed species on CNDDDB field sheets and submit to CDFW.

Valley Elderberry Longhorn Beetle

Conservation measures for VELB are based on USFWS's 1999 *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (Conservation Guidelines) (U.S. Fish and Wildlife Service 1999a).

Conservation Measure 2: Fence Elderberry Shrubs to be Protected and Monitor Fencing during Construction

Elderberry shrubs/clusters within 100 feet of the construction area that will not be removed will be protected during construction. A qualified biologist (i.e., with elderberry/VELB experience), under contract to the implementing agency, will mark the elderberry shrubs and clusters that will be

protected during construction. Orange construction barrier fencing will be placed at the edge of the respective buffer areas. The buffer area distances will be proposed by the biologist and approved by USFWS. No construction activities will be permitted within the buffer zone other than those activities necessary to erect the fencing. Signs will be posted every 50 feet (15.2 meters) along the perimeter of the buffer area fencing. The signs will contain the following information:

This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment.

In some cases, where the elderberry shrub dripline is within 10 feet of the work area, k-rails will be placed at the shrub's dripline to provide additional protection to the shrub from construction equipment and activities. Temporary fences around the elderberry shrubs and k-rails at shrub driplines will be installed as the first order of work. Temporary fences will be furnished, constructed, maintained, and later removed, as shown on the plans, as specified in the special provisions, and as directed by the project engineer. Temporary fencing will be 4 feet (1.2 meters) high, commercial-quality woven polypropylene, orange in color.

Buffer area fences around elderberry shrubs will be inspected weekly by a qualified biological monitor during ground-disturbing activities and monthly after ground-disturbing activities until project construction is complete or until the fences are removed, as approved by the biological monitor and the resident engineer. The biological monitor will be responsible for ensuring that the contractor maintains the buffer area fences around elderberry shrubs throughout construction. Biological inspection reports will be provided to the project lead and USFWS.

Conservation Measure 3: Conduct VELB Surveys Prior to Elderberry Shrub Transplantation

Surveys of elderberry shrubs to be transplanted will be conducted by a qualified biologist prior to transplantation. Surveys will be conducted in accordance with the Conservation Guidelines for the VELB (U.S. Fish and Wildlife Service 1999a). The biologist will survey the area surrounding the shrub to be transplanted to ensure that there aren't additional elderberry shrubs that need to be removed. Surveys will consist of counting and measuring the diameter of each stem, and examining elderberry shrubs for the presence of VELB exit holes. Survey results and an analysis of the number of elderberry seedlings/cuttings and associated native plants based on the survey results will be submitted to USFWS. The data collected during the surveys prior to transplantation will be used to determine if the implementing agency is exceeding their compensation requirements or if additional plantings are necessary. Because the project would be constructed in separate contracts, elderberry survey data for each contract will be used to rectify any discrepancies in compensation for the previous contract and to ensure that impacts to VELB are fully mitigated.

Conservation Measure 4: Water Down Construction Area to Control Dust

The implementing agency or the contractor will ensure that the project construction area will be watered down as necessary to prevent dirt from becoming airborne and accumulating on elderberry shrubs within the 100-foot buffer.

Conservation Measure 5: Compensate for Direct and Indirect Effects on Valley Elderberry Longhorn Beetle Habitat

Project impacts to VELB habitat are discussed in Section 2.3 and compensation ratios are discussed below in Section 3.4.

Giant Garter Snake

Conservation measures for giant garter snake were developed using portions of the *Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Projects with Relatively Small Effects on the Giant Garter Snake within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo Counties, California* (U.S. Fish and Wildlife Service 1997).

Conservation Measure 6: Conduct Construction Activities during the Active Period for Giant Garter Snake

To the maximum extent possible, all construction activity within giant garter snake aquatic and upland habitat within 200 feet of aquatic habitat will be conducted during the snake's active period (May 1–October 1). During this timeframe, potential for injury and mortality are lessened because snakes are actively moving and avoiding danger. Canal relocation at Reaches 22 and 28 to 29 and pipe reconstruction at Reaches 26–28 must be conducted when the canal is dry (February–March). Additional protective measures will be implemented at these locations (see Conservation Measure 14 below).

Conservation Measure 7: Install and Maintain Exclusion and Construction Barrier Fencing around Suitable Giant Garter Snake Habitat

To reduce the likelihood of giant garter snakes entering the construction area, the implementing agency will install exclusion fencing and orange construction barrier fencing along the portions of the construction area that are within 200 feet of suitable aquatic and upland habitat. The exclusion and construction barrier fencing will be installed during the active period for giant garter snakes (May 1–October 1) to reduce the potential for injury and mortality during this activity.

The construction specifications will require that the implementing agency or its contractor retain a qualified biologist to identify the areas that are to be avoided during construction. Areas adjacent to the directly affected area required for construction, including staging and access, will be fenced off to avoid disturbance in these areas. Before construction, the contractor will work with the qualified biologist to identify the locations for the barrier fencing and will place flags or flagging around the areas to be protected to indicate the locations of the barrier fences. The protected area will be clearly identified on the construction specifications. The fencing will be installed the maximum distance practicable from the aquatic habitat areas and will be in place before construction activities are initiated.

The exclusion fencing will consist of 3 foot-tall silt fencing buried at least 4–6 inches below ground level. The exclusion fencing will ensure that giant garter snakes are excluded from the construction area and that suitable upland and aquatic habitat is protected throughout construction. The construction barrier fencing will be commercial-quality, woven polypropylene, orange in color, and 4 feet high (Tensor Polygrid or equivalent). The fencing will be tightly strung on posts with a maximum of 10-foot spacing.

Barrier and exclusion fences will be inspected daily by a qualified biological monitor during ground-disturbing activities and weekly after ground-disturbing activities until project construction is complete or until the fences are removed, as approved by the biological monitor and the resident engineer. The biological monitor will be responsible for ensuring that the contractor maintains the buffer area fences around giant garter snake habitat throughout construction. Biological inspection reports will be provided to the project lead and USFWS.

Conservation Measure 8: Minimize Potential Impacts on Giant Garter Snake Habitat

The implementing agency will implement the following measures to minimize potential impacts on giant garter snake habitat.

- Staging areas will be located at least 200 feet from suitable giant garter snake habitat.
- Any dewatered habitat will remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat.
- Vegetation clearing within 200 feet of the banks of suitable giant garter snake aquatic habitat will be limited to the minimum area necessary. Avoided giant garter snake habitat within or adjacent to the project area will be flagged and designated as an environmentally sensitive area, to be avoided by all construction personnel.
- The movement of heavy equipment within 200 feet of the banks of suitable giant garter snake aquatic habitat will be confined to designated haul routes to minimize habitat disturbance.

Conservation Measure 9: Prepare and Implement a Stormwater Pollution Prevention Plan

Because ground disturbance for the project would be greater than 1 acre, the implementing agency would obtain coverage under the U.S. Environmental Protection Agency's (EPA's) National Pollutant Discharge Elimination System (NPDES) general construction activity stormwater permit. The Central Valley Regional Water Quality Control Board (RWQCB) administers the NPDES stormwater permit program in Sutter and Butte Counties. Obtaining coverage under the NPDES general construction activity permit generally requires that the project applicant prepare a stormwater pollution prevention plan (SWPPP) that describes the BMPs that would be implemented to control accelerated erosion, sedimentation, and other pollutants during and after project construction. The SWPPP would be prepared prior to commencing earth-moving construction activities.

The specific BMPs that would be incorporated into the erosion and sediment control plan and SWPPP would be site-specific and would be prepared by the construction contractor in accordance with the California RWQCB Field Manual. However, the plan likely would include, but not be limited to, one or more of the following standard erosion and sediment control BMPs.

- **Timing of construction.** The construction contractor will conduct all construction activities during the typical construction season to avoid ground disturbance during the rainy season.
- **Staging of construction equipment and materials.** To the extent possible, equipment and materials will be staged in areas that have already been disturbed.
- **Minimize soil and vegetation disturbance.** The construction contractor will minimize ground disturbance and the disturbance/destruction of existing vegetation. This will be accomplished in part through the establishment of designated equipment staging areas, ingress and egress

corridors, and equipment exclusion zones prior to the commencement of any grading operations.

- **Stabilize grading spoils.** Grading spoils generated during the construction will be temporarily stockpiled in staging areas. Silt fences, fiber rolls, or similar devices will be installed around the base of the temporary stockpiles to intercept runoff and sediment during storm events. If necessary, temporary stockpiles may be covered with an appropriate geotextile to increase protection from wind and water erosion.
- **Install sediment barriers.** The construction contractor may install silt fences, fiber rolls, or similar devices to prevent sediment-laden runoff from leaving the construction area. Natural/biodegradable erosion control measures (i.e., coir rolls, straw wattles or hay bales) will be used. Plastic monofilament netting (erosion control matting) will not be allowed because animals can become caught in this type of erosion control material.
- **Stormwater drain inlet protection.** The construction contractor may install silt fences, drop inlet sediment traps, sandbag barriers, and/or other similar devices.
- **Permanent site stabilization.** The construction contractor will install structural and vegetative methods to permanently stabilize all graded or otherwise disturbed areas once construction is complete. Structural methods may include the installation of biodegradable fiber rolls and erosion control blankets. Vegetative methods may involve the application of organic mulch and tackifier and/or the application of an erosion control seed mix. Implementation of a SWPPP will substantially minimize the potential for project-related erosion and associated adverse effects on water quality.

Conservation Measure 10: Prepare and Implement a Bentonite Slurry Spill Contingency Plan (Frac-Out Plan)

Before excavation begins, the implementing agency would ensure the contractor would prepare and implement a bentonite slurry spill contingency plan (BSSCP) for any excavation activities that use pressurized fluids (other than water). If the contractor prepares the plan, it would be subject to approval by USACE, NMFS, and SBFCA before excavation can begin. The BSSCP would include measures intended to minimize the potential for a frac-out (short for “fracture-out event”) associated with excavation and tunneling activities; provide for the timely detection of frac-outs; and ensure an organized, timely, and “minimum-effect” response in the event of a frac-out and release of excavation fluid (i.e., bentonite). The BSSCP would require, at a minimum, the following measures.

- If a frac-out is identified, all work will stop, including the recycling of the bentonite fluid. In the event of a frac-out into water, the location and extent of the frac-out will be determined, and the frac-out will be monitored for 4 hours to determine whether the fluid congeals (bentonite will usually harden, effectively sealing the frac-out location).
- NMFS, CDFW, and the RWQCB will be notified immediately of any spills and will be consulted regarding clean-up procedures. A Brady barrel will be onsite and used if a frac-out occurs. Containment materials, such as straw bales, also will be onsite prior to and during all operations, and a vacuum truck will be on retainer and available to be operational onsite within notice of 2 hours. The site supervisor will take any necessary follow-up response actions in coordination with agency representatives. The site supervisor will coordinate the mobilization of equipment stored at staging areas (e.g., vacuum trucks) as needed.

- If the frac-out has reached the surface, any material contaminated with bentonite will be removed by hand to a depth of 1-foot, contained, and properly disposed of, as required by law. The drilling contractor will be responsible for ensuring that the bentonite is either properly disposed of at an approved Class II disposal facility or properly recycled in an approved manner.
- If the bentonite fluid congeals, no other actions, such as disturbance of the streambed, will be taken that will potentially suspend sediments in the water column.
- The site supervisor has overall responsibility for implementing this BSSCP. The site supervisor will be notified immediately when a frac-out is detected. The site supervisor will be responsible for ensuring that the biological monitor is aware of the frac-out, coordinating personnel, response, cleanup, regulatory agency notification and coordination to ensure proper clean-up, disposal of recovered material, and timely reporting of the incident. The site supervisor will ensure all waste materials are properly containerized, labeled, and removed from the site to an approved Class II disposal facility by personnel experienced in the removal, transport, and disposal of drilling mud.
- The site supervisor will be familiar with the contents of this BSSCP and the conditions of approval under which the activity is permitted to take place. The site supervisor will have the authority to stop work and commit the resources (personnel and equipment) necessary to implement this plan. The site supervisor will ensure that a copy of this plan is available (onsite) and accessible to all construction personnel. The site supervisor will ensure that all workers are properly trained and familiar with the necessary procedures for response to a frac-out, prior to commencement of excavation operations.

Conservation Measure 11: Prepare and Implement a Spill Prevention, Control, and Counter-Measure Plan

A spill prevention, control, and counter-measure plan (SPCCP) is intended to prevent any discharge of oil into navigable water or adjoining shorelines. The implementing agency or its contractor would develop and implement an SPCCP to minimize the potential for and effects from spills of hazardous, toxic, or petroleum substances during construction and operation activities. The SPCCP would be completed before any construction activities begin. Implementation of this measure would comply with State and Federal water quality regulations. The SPCCP would describe spill sources and spill pathways in addition to the actions that would be taken in the event of a spill (e.g., an oil spill from engine refueling would be immediately cleaned up with oil absorbents). The SPCCP would outline descriptions of containments facilities and practices such as doubled-walled tanks, containment berms, emergency shut-offs, drip pans, fueling procedures and spill response kits. It would also describe how and when employees are trained in proper handling procedure and spill prevention and response procedures.

The implementing agency would review and approve the SPCCP before onset of construction activities and routinely inspect the construction area to verify that the measures specified in the SPCCP are properly implemented and maintained. The implementing agency would notify its contractors immediately if there is a non-compliance issue and would require compliance.

The Federal reportable spill quantity for petroleum products, as defined in 40 CFR 110, is any oil spill that results in one or more of the following.

- Violates applicable water quality standards.

- Causes a film or sheen on or discoloration of the water surface or adjoining shoreline.
- Causes a sludge or emulsion to be deposited beneath the surface of the water or adjoining shorelines.

If a spill is reportable, the contractor's superintendent would notify the implementing agency, and the implementing agency would take action to contact the appropriate safety and cleanup crews to ensure that the SPCCP is followed. A written description of reportable releases must be submitted to the Central Valley RWQCB. This submittal must contain a description of the release, including the type of material and an estimate of the amount spilled, the date of the release, an explanation of why the spill occurred, and a description of the steps taken to prevent and control future releases. The releases would be documented on a spill report form.

Conservation Measure 12: Conduct Preconstruction Surveys and Monitoring for Giant Garter Snake

Prior to ground-disturbing activities within 200 feet of suitable habitat, a USFWS-approved biological monitor will conduct a preconstruction survey of suitable aquatic and upland habitat and inspect exclusion and orange barrier fencing to ensure they are both in good working order each morning. If any snakes are observed within the construction area at any other time during construction the USFWS-approved biological monitor will be contacted to survey the site for giant garter snakes. The biological monitor will have the authority to stop construction activities until appropriate corrective measures have been completed or it is determined that the snake will not be harmed. Giant garter snakes encountered during construction activities will be allowed to move away from construction activities on their own. If unable to move away on their own, trapped or injured giant garter snakes will be only be removed by the USFWS-approved biological monitor and will be placed in the nearest suitable habitat that is outside of the construction area. The biological monitor will immediately report these activities to USFWS by phone and will provide a written account of the details of the incident within 24 hours.

Once all initial ground-disturbing activities are completed, the biological monitor will perform weekly checks of the site for the duration of construction in order to ensure that construction barrier fences and exclusion fences are in good order, trenches are being covered, project personnel are conducting checks beneath parked vehicles prior to their movement, and that all other required biological protection measures are being complied with. The biological monitor will document the results of monitoring on construction monitoring log sheets, which will be provided to USFWS within 1 week of each monitoring visit.

Conservation Measure 13: Provide Escape Ramps or Cover Open Trenches at the End of Each Day

To avoid entrapment of giant garter snake, thereby preventing injury or mortality resulting from falling into trenches, all excavated areas more than 1 foot deep will be provided with one or more escape ramps constructed of earth fill or wooden planks at the end of each workday. If escape ramps cannot be provided, then holes or trenches will be covered with plywood or other hard material. The biological monitor or construction personnel designated by the contractor will be responsible for thoroughly inspecting trenches for the presence of giant garter snakes at the beginning of each workday. If any individuals have become trapped, the USFWS-approved biological monitor will be contacted to relocate the snake and no work will occur in that area until approved by the biologist.

Conservation Measure 14: Implement Additional Protective Measures during Work in Suitable Habitat during the Giant Garter Snake Dormant Period

USACE will implement additional protective measures during time periods when work must occur during the giant garter snake dormant period (October 2–April 30), when snakes are more vulnerable to injury and mortality. It is expected that these additional measures will be implemented during canal relocation at Reaches 22 and 28 to 29 and pipe reconstruction at Reaches 26–28 and during February–March, and if construction activities extend to the period between October 2 and November 1. A full-time USFWS-approved biological monitor will be onsite for the duration of construction activities.

- All emergent vegetation within the Sutter-Butte Canal on the levee side, and vegetation within 200 feet of the canal will be cleared prior to the giant garter snake hibernation period (i.e., vegetation clearing must be completed by October 1 for following winter work).
- Exclusion fencing will be installed around the perimeter of the work area and across the Sutter-Butte Canal where construction activities associated with levee slope flattening and pipe reconstruction activities would occur. The fencing should enclose the work area to the maximum extent possible to prevent giant garter snakes from entering the work area. Fencing will be installed during the active period for giant garter snakes (May 1–October 1) to reduce the potential for injury and mortality during fence installation. The USFWS-approved biological monitor will work with the contractor to determine where fencing should be placed and will monitor fence installation. The exclusion fencing will consist of 3 foot-tall erosion fencing buried 4-6 inches below ground level. The exclusion fencing will minimize opportunities for giant garter snake hibernation in the adjacent upland area (between canal and existing levee).

Portions of the Sutter-Butte Canal that are temporarily disturbed during construction will be revegetated with emergent vegetation and adjacent disturbed upland habitat will be revegetated with native grasses and forbs after construction is complete.

Conservation Measure 16: Restore Temporarily Disturbed Aquatic and Upland Habitat to Pre-Project Conditions

To avoid permanent impacts, Upon completion of the construction, USACE will restore temporarily affected suitable and upland habitat for giant garter snake to pre-project conditions within a maximum of one season (a season is defined as the calendar year between May 1 and October 1 [U.S. Fish and Wildlife Service 1997]).

Conservation Measure 17: Compensate for Permanent Loss of Suitable Habitat for Giant Garter Snake

Compensation for permanent effects on giant garter snake aquatic and upland habitat will follow the guidance in the Programmatic Consultation. USACE will compensate for the permanent loss of suitable aquatic habitat and upland habitat for giant garter snake by purchasing preservation credits at a USFWS and CDFW approved conservation bank. Project impacts to GGS are discussed in Section 2.3 and compensation ratios are discussed below in Section 3.4.

2.2 Site Characteristics

2.2.1 Biological Resources in the Project Area

This section identifies the field surveys conducted to identify biological resources known to occur or having the potential to occur in the project area, special-status wildlife and fish species with potential to occur in the project area, and the effects of the project on sensitive biological resources.

Field Surveys

The field surveys conducted to identify biological resources in the project area consisted of habitat mapping, a delineation of wetlands and other waters of the U.S., special-status wildlife surveys, and a tree survey.

Land Cover Mapping

The information pertaining to land cover types in the project area was derived primarily from the collaborative mapping done in November 2010 by ICF International GIS staff and Galloway Consulting and updated as needed based on the results of the 2011 reconnaissance-level biological assessment conducted by ICF International biologists. These 2010 and 2011 field surveys were conducted by combination of aerial photograph interpretation and walking and driving through the project area.

Land cover types in the project area fall into four broad categories: wildlands, potential wetlands and other waters of the U.S., agricultural lands, and developed/disturbed areas.

Delineation of Wetlands and Other Waters of the U.S.

In June, July, and August 2012, HDR conducted a formal delineation of wetlands and other waters for all areas that may potentially be directly affected by construction of the project. Potential borrow site locations were surveyed for wetlands in winter 2012. An approved Preliminary Jurisdictional Delineation for the project area was received on May 1, 2013.

Special-Status Wildlife Surveys

Field surveys to identify habitats for special-status wildlife and elderberry shrub (*Sambucus* spp.) habitat for VELB in the project area were conducted by ICF biologists on July 20–22, July 27, and August 31, 2011. Additional mapping of the elderberry shrubs was conducted by ICF concurrently with arborist surveys in summer 2012. During the 2011 surveys, biologists located elderberry shrubs by driving and walking along the levee in the project area and mapped elderberry shrubs (and shrub clusters) with a sub-meter accuracy global positioning system (GPS). When the bases of shrubs were accessible, stem counts, heights, and widths of shrubs were recorded, and shrubs were surveyed for VELB exit holes. Where dense poison oak (*Toxicodendron diversilobum*), Himalayan blackberry (*Rubus armeniacus*), and/or other vegetation surrounds elderberry shrubs, stem counts and exit hole surveys could not be conducted. Final stem counts will be conducted on all elderberry shrubs prior to removal for transplanting.

An assessment of habitat for giant garter snake was conducted by ICF and HDR biologists on July 12, 2012, and October 25, 2012. During the assessment, biologists evaluated aquatic and upland habitat

for giant garter snake, took representative photographs of habitat present, and recorded all wildlife species observed.

Borrow sites recently have been identified and have not been surveyed yet. Surveys of these sites are planned to occur prior to construction. Any borrow site that contains habitat for listed species will not be utilized.

Tree Survey

ICF arborists assessed trees within the project footprint from July 17 to October 11, 2012. The arborist survey methods followed standard professional practices. Tree location data were collected with a GPS unit. Trees within the defined project footprint, overhanging the project footprint, and greater than 4 inches in DBH were surveyed. Trees were labeled with an aluminum tree tag with unique numbers inscribed on the tags.

The assessment criteria and recorded data from the arborist survey included:

- Identification of the species
- Status of the species
- Number of trunks
- Diameter of trunk 4.5 feet above the ground surface (DBH)
- Tree height
- Canopy dripline radius
- Health, vigor, and structure
- Remarks

For trees with relatively symmetrical canopies, the measurement from the trunk to the end of the longest lateral limb was measured and doubled to determine the diameter of the canopy. For trees with asymmetrical canopies, the diameter of the canopy was determined by adding the distance as measured from the longest lateral limb to the trunk to the distance measured from the trunk to the longest lateral limb on the opposite side of the tree (greater than 90 degrees either side from the first measurement).

Tree health and structure were rated as *good*, *fair*, or *poor*. Table 2-3 provides a general definition of these ratings. Where conditions were between ratings of good and fair or fair and poor, intermediate ratings of fair-good and fair-poor were given.

Table 2-3. Criteria Used to Rate the Health, Vigor, Structure and Form of Surveyed Trees

Rating	Tree Health and Vigor
Good	Overall appearance of the tree is exemplary of the species. No visible wounds or defects, or completely healed. Crown root area displays no signs of wood deterioration. Bark missing from less than 10% of trunk circumference. Trunk does not show any signs of wood decay, cracking, or deterioration. Foliage is exemplary of the species, no sprout growth observed, evenly distributed, and free of pests. No signs of disease symptoms or pests observed. Current annual twig growth is greater than expected for the species. Buds are normal size, viable, abundant, and uniform throughout canopy. Little to no evidence of stress or nutrient deficiency.
Fair	Overall appearance of the tree is representative of the species. Wounds actively healing, but not completely healed. Crown root area displays minor signs of wood deterioration. Bark missing from more than 10% but less than 30% of trunk circumference. Trunk does not show any signs of wood decay, cracking, or deterioration. Foliage is representative of the species, some sprout growth observed, foliage is unevenly distributed yet balanced across whole tree, or only a minor pest problem observed. Disease symptoms or pests observed create an intermittent or temporary nuisance. Current annual twig growth is as expected for the species. Buds are of normal size and viable, but are somewhat sparse or irregular throughout the canopy. Some evidence of minor stress or nutrient deficiency observed.
Poor	Overall appearance of the tree deviates from species representative. Wounds not healing vigorously or are showing signs of decay. Crown root area decayed over more than 30% of tree's cross section. Bark missing from more than 30% of trunk circumference. Trunk shows signs of wood decay, cracking, or deterioration. Foliage deviates from species representative, sprout growth observed, foliage is unevenly distributed, or pest infestation observed. Disease symptoms or pests observed threaten the health and well-being of host and/or adjacent trees. Current annual twig growth is less than expected for the species. Buds are few, or not viable, or sparse, or irregular throughout the canopy. Evidence of stress or nutrient deficiency observed.
Rating	Tree Structure and Form
Good	Tree structure has a low potential for failure. Ample space for tree to grow to mature size characteristic of the species. No visible root defects or damage from roots to infrastructure observed. No anchor roots exposed. Trunk appears solid and free of cavities, decay, or hollowness. No bark inclusion observed. Canopy is full and balanced. Single leader, branch attachment solid, and angle of branch attachment exemplary. No dead limbs observed, all limbs free of defects, and limbs are not overburdened.
Fair	Tree structure has a moderate potential for failure. Adequate space available for tree to grow to a size representative of the species. Roots abutting infrastructure, displacing built objects from normal alignment. Some anchor root exposure. Trunk displays some signs of minor deterioration, but structurally still solid and in process of healing. Bark inclusion observed only on minor branches and away from posing threats to health, safety, and welfare of the public. Canopy is slightly lacking or unbalanced. Leader not clearly defined, but not missing; branch attachment characteristic of species. One minor dead limb observed, but solidly attached, other limbs free of defects, limbs only slightly overburdened.
Poor	Tree structure has a high potential for failure. Inadequate space available for tree to grow to a size representative of the species. Roots lifting sidewalks or built objects from normal grade, extensive portions of root system cut, decay of root crown in excess of 30%, or root zone subject to overwatering. Anchor roots exposed. Trunk decay is affecting 30% or more of the trunk cross section, healing process slow or not evident, or crack observed. Unequal weight distribution within tree structure due to trunk lean. Bark inclusion at branches, involving main trunk, or posing a threat to health, safety, or welfare of the public. Canopy is lacking or unbalanced, or concentrated in the upper 1/3 of tree. Double leader or no leader observed, a branch observed nearly as large as trunk, narrow angles of branch attachment, multiple limb attachments or attachments of limbs not characteristic of species, or decay observed at branch attachment. More than one dead limb observed, a wound in limb observed greater than 30% of cross section, limbs overburdened, or multiple branches sprouting from cuts.

2.2.2 Special-Status Plants

Special-status plant species are plants that are legally protected under CESA, ESA, or other regulations, and species considered sufficiently rare by the scientific community to qualify for such listing.

Nine special-status plant species have been reported in the seven USGS quadrangles that overlap the project area (California Department of Fish and Game 2010; California Native Plant Society 2012; California Department of Fish and Game 2012; U.S. Fish and Wildlife Service 2012). Two species, slender Orcutt grass (*Orcuttia tenuis*) and Greene's tuctoria (*Tuctoria greenei*) are vernal pool species that lack potential habitat in the project area. No vernal pools were observed in the area during the 2010 and 2011 field surveys. Six species were determined to have low potential for occurrence because the potential habitat (i.e., oak woodland, ruderal areas outside the toe of the levee) constitutes a relatively small portion of the biological study area and has been lowered in quality by past and ongoing disturbance (agricultural activities, dredging). Additionally, suitable microhabitat requirements (subalkaline flats, heavy clay soils, acidic clay soils) for these species may not be met.

Sanford's arrowhead is the only special status species that could occur in jurisdictional habitat, including freshwater marshes, sloughs, canals, and other slow moving habitats. It is neither federally or state listed, but is classified as fairly endangered in California according to the California Rare Plant Rank. For the project area, it was determined to have low potential to occur along the edges of irrigation canals, inundated areas of the river's floodplain within riparian forest, and ponds on the land side of the levee that support a fringe of riparian forest.

2.2.3 Special-Status Wildlife Species

Special-status wildlife species are defined as animals that are legally protected under the ESA, CESA, or other regulations and species that are considered sufficiently rare by the scientific community to qualify for such listing. Special-status wildlife species are defined as follows.

- Species that are listed or proposed for listing as threatened or endangered under the ESA (50 CFR 17.11 for listed animals and various notices in the Federal Register (FR) for proposed species).
- Species that are candidates for possible future listing as threatened or endangered under the ESA (77 FR 69993, November 21, 2012).
- Species listed or proposed for listing by the State of California as threatened or endangered under the CESA (14 CCR 670.5).
- Species that meet the definitions of rare or endangered under CEQA (State CEQA Guidelines Section 15380).
- Animals listed as California species of special concern on CDFW's Special Animals List (California Department of Fish and Game 2011).
- Animals that are fully protected in California under the California Fish and Game Code (Sections 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians]).

Based on the USFWS (2012) species list and CNDDDB (California Department of Fish and Game 2012) records search for the quadrangles overlapping the affected area, 23 special-status wildlife species

were identified as having potential to occur in the affected area. Of these 23 species, four are known to occur in the affected area (western pond turtle, Swainson's hawk, western yellow-billed cuckoo, and bank swallow). Swainson's hawk was observed in the affected area during 2011 field surveys. Though not reported to occur in the affected area, 10 other special-status wildlife species have a moderate or high potential to occur in the affected area given their known range, reports of occurrence, and/or the presence of suitable habitat. These species include Antioch Dunes anthicid beetle (*Anthicus antiochensis*), Sacramento anthicid beetle (*A. sacramento*), Sacramento Valley tiger beetle (*Cicindela hirticollis abrupta*), VELB, giant garter snake, northern harrier, bald eagle, western burrowing owl, tricolored blackbird, and silver-haired bat. The remaining nine species have low or no potential to occur. Seven additional species were added as having at least a moderate potential to occur in the affected area based on species habitat requirements and professional judgment (white-tailed kite, loggerhead shrike, purple martin, yellow warbler, pallid bat, hoary bat, and western red bat).

ESA Consultation to Date

Of the 10 federally listed species considered for inclusion, only VELB and the giant garter snake have the potential to be affected by the project.

USACE, pursuant to ESA, must consult with USFWS with regard to any proposed actions that may affect the continued existence of a federally listed species. Following is a summary of communications with USFWS for the project.

The Corps has determined that the proposed project may affect, and is likely to adversely affect the federally-listed as threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (beetle) and the giant garter snake (*Thamnophis gigas*) snake. A Biological Opinion (08ESMF00-2013-F-0342-1) was received from USFWS on May 2, 2013 concurring with the Corps determination and that critical habitat will not be affected concluding ESA section 7 consultation for the proposed project.

Project impacts to VELB and GGS habitat are discussed below.

Valley Elderberry Longhorn Beetle

Status and Distribution

VELB was listed by USFWS as a threatened species on August 8, 1980 (45 FR 52803–52807), due to loss of habitat and inadequate regulatory protection. The current known range of VELB extends from southern Shasta County, south to Fresno County, and from the east side of the Coast Range to the Sierra Nevada foothills (Barr 1991; U.S. Fish and Wildlife Service 2006). The USFWS promulgated the final ruling designating critical habitat for VELB on August 8, 1980 (45 Federal Register [FR] 52804). Two critical habitat areas were designated along portions of the American River in Sacramento County (the Sacramento Zone and the American River Parkway Zone). The Proposed Action addressed in this BA is not located within designated critical habitat for VELB. Critical habitat has not been designated for giant garter snake. Accordingly, critical habitat is not discussed further in this BA.

In 2006, USFWS released a 5-year review for VELB that recommended delisting the species due to reduction of its primary threats (loss of riparian and inadequacy of regulatory mechanisms) and the increased number of occurrences in the Central Valley (U.S. Fish and Wildlife Service 2006). The

report recommended a post-delisting monitoring plan that includes monitoring of the 195 known VELB locations. The purpose of the plan would be to ensure that VELB remains stable after ESA protections are removed.

On August 19, 2011, USFWS announced a 90-day finding on a petition to delist VELB (76 FR 51929–51931). USFWS found that the petition presented substantial scientific or commercial information indicating that delisting may be warranted and requested further scientific and commercial data and other information regarding VELB. Following the review of additional information, USFWS will issue a 12-month finding on the petition, which will address whether the petitioned action is warranted.

Habitat and Biology

VELB is dependent on its host plant, elderberry, which is a common component of riparian corridors and adjacent upland areas in the Central Valley. VELB has four stages of life: egg, larva, pupa, and adult. Females deposit eggs on or adjacent to the host elderberry. Egg production varies and females have been observed to lay between 16 and 180 eggs (U.S. Fish and Wildlife Service 2007). Eggs hatch within a few days of being deposited and larvae emerge. The larvae bore into the wood of the host plant and create a long feeding gallery in the pith of the elderberry stem. The larvae feed on the pith of the plant for 1–2 years. When a larva is ready to pupate, it chews an exit hole to the outside of the stem and then plugs it with frass. The larva then retreats into the feeding gallery and constructs a pupal chamber from wood and frass. The larvae metamorphose between December and April; the pupal stage lasts about a month. The adult remains in the chamber for several weeks after metamorphosis and then emerges from the chamber through the exit hole. Most records for adults show occurrence from late-April to mid-May (U.S. Fish and Wildlife Service 2007). Adults feed on elderberry leaves and mate within the elderberry canopy.

Studies conducted in the American River basin demonstrate that VELB occurs most frequently and is most abundant in significant riparian zones that are well developed. Within significant riparian zones, VELB primarily occurs within the riparian corridor but can occur infrequently in non-riparian scrub habitats adjacent to the riparian corridor. Along the American River, the beetle tends to occupy woodlands dominated by exotic trees (black locust [*Robinia pseudoacacia*]) and black walnut [*Juglans californica*]), and in mixed riparian forests. The beetle less commonly occupies annual grasslands and live oak woodlands. One study showed that the beetle preferentially occupies elderberry shrubs in wooded areas with a relatively dense canopy cover over elderberry shrubs located in open and sparsely wooded areas. Of the occupied shrubs found in wooded areas, about 50% were under a canopy cover of 25–50%, while 25% were under canopies with 50–75% cover and 25% were under canopies with 75–100% cover. The study also demonstrated that VELB appears to be capable of limited dispersal and prefers to remain within contiguous patches of high quality riparian habitat. Clusters of local aggregations of VELB along the American River Parkway were approximately 600–800 meters in diameter (Talley 2005 in Talley et al. 2006).

A variety of branch sizes are utilized for larval development and pupation, although most of those measured in Barr's study (1991) were 2–4 inches (5–10 centimeters) in diameter at the exit hole. Infrequently, smaller branches (less than 1.5 inches [3.8 centimeters] in diameter) that contained exit holes were encountered. Lang et al. (1989) found no current-year exit holes on stems smaller than 1 inch (2.5 centimeters) in diameter. Talley et al. (2007) found that exit holes most frequently occurred in stems that were 0.8–2.8 inches (2–7 centimeters) in diameter and below 3.2 feet (1 meter) (79%). Holes were also found in larger diameter stems (2.8–4.7 inches [7–12 centimeters]) (36% of occurrences) and at heights of 3.2–6.4 feet (1–2 meters) above the ground (19%).

Reasons for Decline

The primary threat to VELB has been attributed to habitat loss and degradation of the riparian forest ecosystem as a result of agricultural and urban development (Barr 1991; Barbour et al. 1993; Eng 1984; Kucera and Barrett 1995; Katibah 1984). Colonization by the Argentine ant (*Linepithema humile*) may also pose a biological threat to VELB through egg predation (Huxel 2000).

Occurrence in the Project Area

The closest VELB occurrence in the CNDDDB (California Department of Fish and Game 2012) is approximately 0.5 mile from the project area. Numerous other occurrences are located within 10 miles of the project area.

Suitable habitat for VELB is located at numerous places in the project area along the levee construction footprint. There were no elderberry shrubs observed at the five borrow site locations during the wetlands delineation effort at these sites. A total of 267 shrubs/shrub clusters were mapped in the project area. Because of property inaccessibility and the high density of California grape and Himalayan blackberry along portions of the Feather River riparian corridor, stem counts and examination of shrubs for VELB exit holes could only be conducted for 73 shrubs/shrub clusters in the project area.

Effects of the Project on Valley Elderberry Longhorn Beetle

Direct effects are defined as the direct or immediate effects of a proposed action on a species or its habitat. Direct effects may result from the action and may include the effects of interrelated and interdependent actions. An *interrelated action* is an activity that is part of the proposed action and depends on the proposed action for its justification. An *interdependent action* is an activity that has no independent utility apart from the action under consultation (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998).

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Indirect effects may occur outside the area directly affected by the action (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998).

Direct Effects

Permanent Loss of Elderberry Shrubs and Potential Loss of Individual VELB from Shrub Removal

Removal of habitat (elderberry) and potential injury or mortality of VELB associated with construction of the project would be considered direct effects on VELB. Trimming of elderberry branches that are 1 inch or greater in diameter could also result in injury or mortality of VELB. Because VELB larvae may feed on the roots of elderberries, disturbance of elderberry roots within the shrub dripline could also result in injury or mortality of individuals. Where root damage is expected to be extensive, elderberry shrubs would be removed. Where damage is limited (few roots affected) and roots are expected to grow back, impacts would be considered temporary. Because incidental take of VELB would be difficult to detect or quantify, effects on elderberry shrubs will be used as a proxy for measuring take.

Elderberry shrubs within the construction area that cannot be protected will be removed in accordance with to USFWS-approved procedures outlined in the Conservation Guidelines (U.S. Fish and Wildlife Service 1999a). Shrubs will be transplanted to the Star Bend Conservation Area.

Transplanted shrubs will be moved prior to construction when the plants are dormant, approximately November through the first 2 weeks in February, after they lose their leaves. Transplanting during the dormant period will reduce shock to the plant and increase transplantation success. However, transplanted elderberry shrubs may experience stress, a decline in health, or death due to changes in soil, hydrology, microclimate, or associated vegetation.

Elderberry shrubs that can be avoided at the dripline of the shrub or greater distance will be protected with fencing and/or k-rail as described in Conservation Measure 2. Based on the location of shrubs in the project footprint, there is anticipated to be 162 elderberry shrubs that will require transplantation during construction of the project.

As described in Conservation Measure 3, surveys of elderberry shrubs to be transplanted will be conducted by a qualified biologist prior to transplantation. The data collected during the surveys prior to transplantation will be used to determine if compensation requirements are being met, or if additional plantings are necessary. Because the project would be constructed in six separate contracts, elderberry survey data for each contract will be used to rectify any discrepancies in compensation for the previous contract, and ensure that impacts are being fully mitigated. Compensation ratios for VELB habitat is discussed below in Section 3.4.

Indirect Effects

As discussed above, *indirect effects* are caused by or result from the project, are later in time, and are reasonably certain to occur. Indirect effects may occur outside the area directly affected by the action.

Loss of Connectivity to Adjacent Habitat

Loss of connectivity between elderberry shrubs may result when elderberries or associated vegetation is removed. Removal of such vegetation could result in gaps in vegetation that are too wide for VELB to travel across due to their fairly limited movement distances (Talley et al. 2006a), resulting in separation of individuals or reducing the possibility of colonization of adjacent areas. Removal of associated vegetation may result in an altered habitat structure or microclimate that could affect behaviors of VELB in response to these changes in unforeseen ways (U.S. Fish and Wildlife Service 2003).

Although more research is needed, VELB has been observed to fly a mile or more in contiguous or fairly contiguous habitat, and exit holes have been observed on isolated shrubs that are a minimum of 0.25 mile (0.4 kilometer) from the next nearest elderberry (Arnold pers. comm. 2011). Within the American River Basin, evidence suggests that local beetle movements are farther within the riparian corridor (141±144 feet [43±44 meters]) than in the adjacent non-riparian scrub (82±52 feet [25±16 meters]) (average±1 standard deviation nearest neighbor distances between recent exit holes) illustrating that VELB population extents may also be habitat-specific (Talley et al. 2006a).

Soil Disturbance Adjacent to Roots

Ground disturbance within 20 feet (6.1 meters) of an elderberry shrub's dripline could result in disturbance of roots. Root damage could result in stress or reduced vigor of elderberry shrubs. Because construction of the project may result in disturbance within 20 feet (6.1 meters) of the dripline of elderberry shrubs, indirect effects on these shrubs may result. Elderberry shrubs will be fenced and/or protected with k-rail, as described in Conservation Measure 2, to minimize soil disturbance adjacent to roots. With this measure in place, and because elderberry shrubs are hearty

and frequently re-sprout after damage, this indirect effect is not expected to substantially affect VELB.

Dust

Vehicle travel on the levee road adjacent to elderberry shrubs during construction of the project could result in dust becoming airborne and settling on elderberries. The levee road is graveled, and existing shrubs are and have been exposed to dust from vehicles associated with farming and levee maintenance. Construction of the project would increase the amount of dust in the project area as a result of ground-disturbing activities and an increase in the frequency of vehicles driving on the levee road. The amount of dust in the project area would be minimized through dust control measures, as described in Conservation Measure 4. Additionally, according to Talley et al. (2006b), in an experiment along the American River Parkway (Sacramento County) conditions of elderberry shrubs related to dust from nearby trails and roads (paved and dirt) did not affect the presence of VELB. Additional work by Talley and Holyoak (2009) found no effect on elderberries from dust accumulations. Because dust has not been found to greatly affect elderberry shrubs and because dust control measures would be implemented during construction, this indirect effect is not expected to substantially affect VELB.

Altered Hydrology

Reduction of water to elderberry shrubs as a result of altered hydrology from changes in topography or compaction of soil could result in reduced shrub vigor/vitality and an associated decrease in shoot, leaf, and flower production and ultimately reduce the suitability of the shrubs to provide habitat for VELB. In most portions of the project area, the levee will be degraded and re-built within the same footprint, and would not modify the hydrology of the surrounding area where elderberries may be present. There may be a few instances where the slope is modified or there are other changes that may affect the hydrology in the project area. These situations are expected to be rare. Additionally, a substantial portion of the elderberries are located within riparian woodland along the Feather River and obtain water from within the river channel, which will not be hydrologically changed as a result of the project. Therefore, altered hydrology as a result of the project is not expected to substantially affect VELB.

Existing Elderberry Shrubs in the Conservation Area

As described in Conservation Measure 5, elderberry shrubs to be removed will be transplanted to the Star Bend Conservation Area, which contains existing elderberry shrubs. Although transplantation activities may occur within 100 feet of existing elderberry shrubs, it is unlikely that they would be indirectly affected by transplantation activities, as the transplantations would be conducted by qualified individuals who would be knowledgeable about elderberry shrubs and the existing conditions within the conservation area.

Temporal Loss of Habitat

It generally takes 5 or more years for newly planted elderberry cuttings/seedlings to become large enough to support beetles, and it generally takes 25 years or longer for riparian habitats to reach their full value (U.S. Fish and Wildlife Service 1994). Because elderberry shrubs within the project area will be transplanted to the Star Bend Conservation Area, which is immediately adjacent to the project area, no temporal loss of habitat for VELB is expected. Additional elderberry plantings in the conservation area will provide additional and/or replacement habitat for VELB in future years.

Giant Garter Snake

Status and Distribution

Giant garter snake was listed as a threatened species by USFWS on October 20, 1993 (58 FR 54033). The species is also State-listed as threatened. Giant garter snake is endemic to the Sacramento and San Joaquin Valleys where it is found in lowland areas (U.S. Fish and Wildlife Service 1999b). Historically, this species was found throughout the Central Valley from Butte County in the north to Kern County in the south. Currently, giant garter snake is only known to occur in 13 discrete populations in the Sacramento and San Joaquin Valleys in Butte, Colusa, Fresno, Glenn, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo Counties (U.S. Fish and Wildlife Service 1999b:9, 11–12).

Habitat and Ecology

Giant garter snakes inhabit agricultural wetlands and other waterways including irrigation and drainage canals, ricelands, marshes, sloughs, ponds, small lakes, and low gradient streams, as well as adjacent upland areas in the Central Valley. Because of the direct loss of natural habitat, giant garter snake relies heavily on rice fields in the Sacramento Valley, but it also uses managed marsh areas in national wildlife refuges and State wildlife areas.

Habitat requirements for giant garter snake consist of the following.

- Adequate water during the snake's active season (early spring through mid-fall) to provide food and cover.
- Emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat during the active season.
- Grassy banks and openings in waterside vegetation for basking.
- Higher elevation uplands for cover and refuge from flood waters during the snake's dormant season in the winter.

Giant garter snake can persist in waterbodies that contain predatory fish if sufficient cover is present. It is typically absent from larger rivers because of lack of suitable habitat and emergent vegetative cover; it is also typically absent from wetlands with sand, gravel, or rock substrates. Riparian woodlands typically do not provide suitable habitat because of excessive shade, lack of basking sites, and absence of prey populations.

Giant garter snake inhabits small mammal burrows and other soil crevices above prevailing flood elevations throughout its winter dormancy period (November through mid-March), where it typically selects burrows with sunny exposure along south and west facing slopes. The breeding season extends from March through May and resumes briefly in September. Females give birth to live young from late July through early September. Giant garter snake feeds primarily on small fishes, tadpoles, and frogs (U.S. Fish and Wildlife Service 1999b:12, 13, 22, 24).

Reasons for Decline

Giant garter snake has been extirpated from the southern third of its range as a result of agricultural and flood control activities, which have eliminated the snake's freshwater marsh habitat in the historical Buena Vista, Tulare, and Kern lakebeds. Much of the habitat on the floor of the Central

Valley has been lost or degraded by upstream watershed modifications, water storage and diversion projects, and urban and agricultural development. Other negative factors that may be contributing to the decline of giant garter snakes include interrupted water supply, poor water quality, and contaminants (U.S. Fish and Wildlife Service 1999b:25.)

Occurrence in the Project Area

There are no CNDDDB records of occurrences of giant garter snake in the project area; however, there are 20 records of occurrences within 5 miles of the project area (California Department of Fish and Game 2012). The information for some of these records is suppressed, but the closest available occurrence is approximately 2 miles from the project area (California Department of Fish and Game 2012).

Within the project area, suitable aquatic habitat for giant garter snake is present within rice fields, irrigation canals, drainage canals, and ponds. Some of the drainage canals and ponds in the project area provide suitable aquatic habitat but do not have connectivity to other water features except the Feather River (which is not considered suitable habitat).

Canals

Canals in the project area consist of the Sutter-Butte Canal and other linear, concrete-lined features that convey water across multiple parcels. Many of these features have no vegetation present, while some have herbaceous emergent (rooted) vegetation and shrubs present in the margins. These canals generally convey water only during the active agricultural periods, which take place between April 15 and February 15.

Suitable upland habitat in the project area is limited to the levee banks and adjacent ruderal areas. Giant garter snakes (if present) are expected primarily to be associated with aquatic habitat in the project area. Table 2-5 provides a summary of the suitability of potential aquatic habitat in the levee construction portion of the project area. Table 2-6 provides a summary of the suitability of potential borrow sites to provide habitat for giant garter snake.

Table 2-5. Suitability of Aquatic Habitat for Giant Garter Snake in the Levee Construction Portion of the Project Area

Approximate Stationing	Aquatic Habitat	Suitability for Giant Garter Snake
208	Perennial ponded area, ditch along levee toe	Suitable aquatic—limited upland, no connectivity to other aquatic.
233	Ditch on land side of levee	Suitable aquatic.
254–258	Pond	Suitable aquatic—limited upland, no connectivity to other aquatic.
280	Canal	Suitable aquatic (low quality) —limited upland, has connectivity to other canals/ditches.
292	Concrete lined canal	Suitable—isolated segment but near other canals.
310	Perennial pond	Suitable aquatic—burrows in grassy hillside and levee side, channel from pond continues north along base of levee and also provides habitat.
336	Perennial pond	Dense willow ring, limited basking areas and upland, limited suitability/low potential for species.

Approximate Stationing	Aquatic Habitat	Suitability for Giant Garter Snake
373	Open channel on water side of levee	Suitable aquatic.
396	Canal	Suitable aquatic.
409–410	Cement-lined storage pond	Not suitable—concrete-lined and fenced.
409–410	River backwater, freshwater emergent, and seasonal wetland	Marginal aquatic—area connected to river with marsh.
426	Channel with marsh (seasonal wetlands)	Suitable aquatic—open areas for basking, side of levee may provide upland.
434	Perennial pond	Suitable aquatic—open areas for basking, side of levee provides upland habitat.
512	Canal	Not suitable—canal is concrete-lined, used for drainage, and not connected to other canals/ditches and water not maintained.
544–577	Abbott Lake	Suitable aquatic—open areas for basking, limited upland habitat, connected “channel” along base of levee to the north also provides suitable aquatic.
647–649	Cement-lined storage pond	Not suitable.
689	Canal	Assumed suitable—appears to connect to other canals/ditches, limited suitable upland.
872–880	Seasonal wetland	Wetland feature observed dry during October 25, 2012 site visit. Not suitable—likely does not stay inundated through summer, may not have open water.
1043–1052	Detention pond	Not suitable—unvegetated and unlikely to sustain water through summer.
1043	Stream	Not suitable—stream isolated by river and development.
1060	Stream	Not suitable—stream isolated by river and development.
1375	Unlined canal	Suitable habitat—water present throughout the summer.
1428	Start of Sutter-Butte Canal	Suitable throughout the project area—water year-round, some patches of suitable emergent vegetation, connectivity to other canals/ditches.
1707	Canal	Similar to the Sutter-Butte Canal, suitable aquatic—connectivity to other canals/ditches.
1761–1766	Ditch	Not suitable—ditch is not very defined and is isolated.
1902	Ditch	Suitable aquatic—ditch had water on October 25, 2012 site visit, ditch is small and isolated but is in close proximity to the Sutter-Butte Canal.
1958	Canal/ditch	Assumed suitable—connected to Sutter-Butte Canal.
2076, 2122, 2217, 2262	Ponds in tailings area	Marginal suitability—aquatic areas appear suitable at base, but are often surrounded by steep mounds of tailings; availability of food is questionable; upland areas are rocky and are unlikely to provide burrows.
2359	Canal	Assumed suitable—it connects to other canals and ditches, although canal has stagnant water and really steep sides.

Table 2-6. Habitat Suitability of Potential Borrow Sites for Giant Garter Snake

Potential Borrow Site	Habitat Present	Habitat Suitability
Oroville Wildlife Area Dredge Tailings Area	Tailings with emergent vegetation	Not considered suitable—aquatic areas appear suitable at base, but are often surrounded by steep mounds of tailings; availability of food is questionable; upland areas are rocky and are unlikely to provide burrows.
City of Live Oak Detention Basin	Irrigation ditch and grassland	Suitable—irrigation ditch along the edge of the property extends beyond the potential borrow site and provides suitable aquatic habitat; adjacent grassland provides suitable upland habitat.
South Ella Detention Pond	Ruderal grassland	Not suitable—no reported aquatic habitat within 200 feet of potential detention pond borrow site.
Lanza 40-acre property	Agricultural/row crops	Suitable—irrigation ditch along the edge of the property provides suitable aquatic habitat but adjacent area where borrow would be removed is not suitable (i.e., no impacts to irrigation ditch).
Marler property	Agricultural/row crops	Not suitable—no aquatic or upland habitat present.

Effects of the Project on Giant Garter Snake

Suitable aquatic habitat for giant garter snake in the project area consists of rice fields, irrigation canals, drainage canals, and ponds. Suitable upland habitat consists of ruderal grassland on the levee banks and adjacent to the levee banks. For the effects discussion below, impacts on ruderal grassland areas were calculated if they occur within 200 feet of suitable aquatic habitat.

Permanent and Temporary Disturbance of Suitable Aquatic and Upland Habitat for Giant Garter Snake

Permanent and temporary losses of suitable aquatic and upland habitat for giant garter snake within the project area are summarized in Table 2-7. Construction of SB-8 would result in the permanent loss of 3.54 acres of suitable upland habitat for giant garter snake. The permanent loss results from the installation of 3,700 linear feet of landside levee slope erosion protection (anchored high performance turf reinforced mat). Construction of SB-8 would also result in the temporary loss or disturbance of 118.80 acres of suitable upland habitat for giant garter snake. Temporary impacts to suitable upland habitat would mostly occur along the levee and at the City of Live Oak Detention Basin borrow site.

Permanently impacted suitable upland and aquatic habitat for giant garter snake would be compensated for through purchasing preservation credits equal to 22.5 acres of giant garter snake habitat at Westervelt Ecological Services' Sutter Basin Conservation Bank in Sutter County, as described in Conservation Measure 17.

Temporarily affected aquatic and upland habitat would be restored to pre-project conditions within a maximum of one season (a season is defined as the calendar year between May 1 and October 1 [U.S. Fish and Wildlife Service 1997]), as described in Conservation Measure 16.

If additional impacts to giant garter snake habitat are expected to occur within or outside of the project area, USACE will consult with USFWS to determine whether reinitiation of Section 7 consultation is necessary to address these additional effects.

Disturbance or degradation of suitable aquatic habitat for giant garter snake in the project area could occur if soil or other materials are sidecast or fall into the habitat. Fuel or oil leaks or spills adjacent to aquatic habitat could also cause degradation of habitat. These potential effects would be avoided by installing sediment and construction barrier fencing (Conservation Measure 7), locating staging areas away from aquatic habitat (Conservation Measure 8), implementing sediment and contaminant BMPs as required by the NPDES permit (SWPPP) (Conservation Measure 9), and preparing a frac-out plan and SPCCP (Conservation Measures 10 and 11).

Table 2-7. Effects on Giant Garter Snake Habitat in the project area

Habitat	SB8 Levee Construction Area	Borrow Sites in Acres	SB8 Total Acreage
Temporary Effects			
Aquatic habitat	11.9	127.72	139.62
Upland habitat (ruderal within 200 feet of aquatic habitat)	96.79	175.47	272.26
Permanent Effects			
Aquatic habitat	0	0	0
Upland habitat (ruderal within 200 feet of aquatic habitat)	3.54	0	3.54

Potential Injury or Mortality of Giant Garter Snake

Construction activities in suitable habitat could result in the injury, mortality, or disturbance of giant garter snakes. Giant garter snakes could be injured or crushed by construction equipment working in suitable aquatic and upland habitat, or if soil or other materials are side-cast or fall into suitable aquatic habitat. Snakes could also be killed by construction vehicles traveling through the project area. Fuel or oil spills from construction equipment into aquatic habitat could also cause illness or mortality of giant garter snakes. Trenches left open overnight could trap snakes moving through the construction area during the early morning hours. Noise and vibrations from construction equipment, and presence of human activity during construction activities may also disturb giant garter snakes within the project area.

Most construction activities will be limited to the snake's active period (May 1–October 1) when the potential for direct mortality is reduced because snakes can actively move and avoid danger. However, realignment work for the Sutter-Butte Canal (Reaches 22, 28-29) requires construction during February and March when the irrigation canal is dry. Giant garter snakes, if present, in the upland ruderal grassland adjacent to the canal could be injured or killed during work within the snake's dormant period. Conservation Measure 14 would be implemented to reduce the potential for mortality.

Potential effects on giant garter snake would be minimized or avoided by conducting biological resources awareness training (Conservation Measure 1), conducting work during the active period (May 1–October 1) (Conservation Measure 6), installing exclusion fencing around suitable habitat (Conservation Measure 7), conducting preconstruction surveys and monitoring (Conservation

Measure 12), and providing escape routes or covering open trenches (Conservation Measure 13). If work continues past October 1, additional preconstruction surveys and monitoring will be required (Conservation Measure 14).

Indirect Effects

Construction of the project is not expected to have any indirect effects on giant garter snake. Two potential indirect effects on giant garter snake and its habitat were considered but were determined to have no potential to occur as a result of the project. Specifically, the following determinations were made.

- There would be no increase of trash, hazardous waste, or off-road vehicle use due to increased human presence. The project would not result in development or increased access to giant garter snake habitat.
- The project would not result in indirect effects on habitat suitability through changes in the length of inundation or other habitat modifications that would make the habitat less suitable for giant garter snake.

Cumulative Effects

As described above, cumulative effects are future State, local, and private actions not involving a Federal action that are reasonably certain to occur within the action area under consideration. No other actions within the action area are proposed at this time. Therefore, no cumulative effects would result from the proposed action.

Future Federal actions that are unrelated to the project are not considered in this section because they would be subject to separate consultation pursuant to Section 7 of the ESA.

2.2.4 Special-Status Fish Species

Several special-status fish species occur or have the potential to occur in or near the study area. Critical habitat for spring-run Chinook salmon and Central Valley steelhead falls within the study area in the Feather River. In addition, the Feather River is designated critical habitat for green sturgeon (74 FR 52345 October 9, 2009). While the Feather River is not designated critical habitat for winter-run Chinook salmon, effects on this species were considered as they have the potential to occur in the study area for at least part of their life-cycle.

No construction activities are proposed in-river or below ordinary high water mark (OHWM); all activities that would result in physical disturbance and removal of vegetation on the waterside slope of the levee would be limited to areas above OHWM. Therefore, no physical modification of critical habitat for ESA-listed fish species would be expected because all proposed construction activities would occur above the OHWM of the Feather River. No mitigation measures are required for special-status fish due to project impacts. Loss of waterside riparian habitat that may indirectly affect fish habitat is being compensated for as described below.

2.2.5 Riparian Forest

Riparian forest occurs along the Feather River, on the waterside and landside of the levees, and forms a fringe around ponds. Riparian forests support an overstory dominated by mature native and nonnative trees. The dominant overstory species are valley oak (*Quercus lobata*), Fremont

cottonwood (*Populus fremontii* ssp. *fremontii*), or Goodding's black willow (*Salix gooddingii*). Other trees commonly observed in the riparian forest are box elder (*Acer negundo* var. *californicum*), arroyo willow (*S. lasiolepis*), Oregon ash (*Fraxinus latifolia*), and western sycamore (*Platanus racemosa*). The shrub layer of most of the riparian forest in the biological study area is extremely dense, and species commonly observed are Himalayan blackberry, poison oak, button bush (*Cephalanthus occidentalis*), wild rose (*Rosa* spp.) and blue elderberry (*Sambucus nigra* ssp. *caerulea*). Blue elderberry is the host plant for the valley elderberry longhorn beetle, federally listed as threatened. Many of the trees and shrubs in the riparian forest are covered in California grape (*Vitis californica*). The herbaceous understory of riparian forest contains a mixture of native and introduced species. Representative species observed were horsetails (*Equisetum* spp.), mugwort (*Artemisia douglasiana*), and curly dock (*Rumex crispus*). Several patches of the invasive giant reed (*Arundo donax*) occur along the edges of riparian areas.

Effects of the Project on Riparian Forest

An arborist survey of the project area was conducted during the summer of 2012 to identify riparian trees that would be affected by the project. Cutoff wall and seepage berm construction would require removal of vegetation within the construction footprint. An additional amount of riparian habitat located in the ETL vegetation-free zone could require removal to comply with USACE levee vegetation policy. A variance under the policy would reduce this loss.

Construction of the project is estimated to impact 42.50 acres of riparian forest and scrub shrub riparian habitat (USFWS Draft Coordination Act Report). Tree survey dripline canopy data indicates that this impact acreage provides in total 2.88 acres of riparian tree canopy. Impacts to riparian trees were generated from data collected during the arborist survey described above in Section 2.3.1.

Vegetation removed would not be restored onsite because riparian restoration would not be permitted on the levees or seepage berms as it would conflict with USACE levee vegetation policy. The policy requires that the crown, slopes, and areas within 15 feet of the waterside and landside levee toes be maintained free of all woody vegetation.

Riparian communities, including cottonwood riparian woodland and valley oak riparian woodland, are considered sensitive natural communities by the CNDDDB (California Department of Fish and Game 2012). These woodlands would be regulated by CDFW and USFWS (46 FR 7644) under no-net-loss policies for existing riparian habitat values.

2.2.6 Oak Woodland

The biological study area contains several small patches of oak woodland. The overstory of oak woodlands is predominantly valley oak but some ornamental tree species are also present. The understory of oak woodland contains annual grasses mixed with native and nonnative forbs. Representative understory species are wild oat (*Avena* spp.), soft chess (*Bromus hordeaceus*), ripgut brome (*B. diandrus*), field hedge parsley (*Torilis arvensis*), and the invasive yellow starthistle (*Centaurea solstitialis*).

Construction of the project is estimated to impact 1.30 acres of oak woodland (USFWS Draft Coordination Act Report). Tree survey dripline canopy data indicates a loss of oak trees totaling 10.12 acres of non-riparian native tree canopy. Impacts to non-riparian native trees were generated from data collected during the arborist survey described above in Section 2.3.1.

2.2.7 USACE Section 404 Jurisdictional Areas

The project area contains numerous features that are potential wetlands and other (i.e., non-wetland) waters of the United States that may be subject to USACE jurisdiction under Section 404 of the Clean Water Act (CWA). An approved Preliminary Jurisdictional Delineation for project site was received on May 1, 2013 from the USACE Sacramento District.

Affected Wetland and Other Water Types

The types and acreages of wetlands and other waters that would be affected by the proposed project are listed below in Table 2-8. A description of each type of affected wetland and other water is provided below.

Table 2-8. Acreages of Affected Wetlands and Other Waters

Land Cover Types	SB8 Alternative - Permanent	SB8 Alternative - Temporary
Irrigation/canal ditch	4.19	3.08
Riparian forest wetland	0.005	0.324
Forested Wetland	0.002	0
Drainage Fixture	0.006	0.008
Tailings wetland	0.911	0.11
Seasonal wetlands	0.026	0
Open water	0.038	0
Subtotal	5.178	3.099

Irrigation Ditches/Canals

The drainage ditches and canals scattered within the biological study area are anthropogenic features that drain water from active agricultural lands during the growing season or following a rain event. They consist of the Sutter-Butte Canal, and other linear, concrete-lined features that convey water across multiple parcels. Many of these features are unvegetated; however, some support emergent vegetation or shrubs along their margins.

Open Water

In addition to providing habitat for fish, open water provides foraging, cover, and reproductive sites for a variety of wildlife species. Open water areas provide essential foraging habitat for a variety of birds, including wading birds such as great blue heron, great egret, and snowy egret (*Egretta thula*); waterfowl such as northern shoveler (*Anas clypeata*), northern pintail (*Anas acuta*), common goldeneye (*Bucephala clangula*), mallard (*Anas platyrhynchos*), common merganser (*Mergus merganser*), ruddy duck (*Oxyura jamaicensis*), gadwall (*Anas strepera*), and cinnamon teal (*Anas cyanoptera*); other water birds such as eared grebe (*Podiceps nigricollis*), double-crested cormorant (*Phalacrocorax auritus*), and American white pelicans (*Pelecanus erythrorhynchos*); and land birds such as bald eagle (*Haliaeetus leucocephalus*), bank swallow (*Riparia riparia*), and belted kingfisher (*Megasceryle alcyon*).

Reptiles and amphibians, including western pond turtle, common garter snake, western aquatic garter snakes (*Thamnophis couchii*), Pacific tree frog, western toad, and bullfrog, use open water

areas for breeding, foraging, and cover. Canals and ditches that contain water through mid-fall, have suitable prey, and adequate cover and foraging habitat have the potential to support giant garter snake (*Thamnophis gigas*).

Mammals that use open water habitats for foraging include bats such as California myotis, Yuma myotis, hoary bat, and western red bat, which forage for insects over open water. Additionally, terrestrial mammals such as black-tailed deer, raccoon, striped skunk, and Virginia opossum use open water habitats as water sources. Aquatic and semi-aquatic mammals that occur in open water habitats include beaver, river otter (*Lutra canadensis*), mink (*Mustela vison*), and muskrat.

Riparian Forest Wetlands

Forested/shrub wetlands occur on the waterside of the levee along the margins of the Feather River (but are outside the OHWM of the river) and are concentrated in the southern half of the biological study area. The vegetation in riparian forest wetlands is comparable to that of non-wetland riparian forest and non-wetland riparian scrub-shrub (described above); however, the forested/shrub wetlands exhibit positive indicators of all three Federal wetland criteria.

Tailing Ponds

Tailing ponds are concentrated in the northern portion of the project area. As indicated, these waterbodies formed in the tailings from dredge mining and are ringed by trees and shrubs. Similar to freshwater emergent wetlands, tailing ponds with standing water typically contain a mixture of floating and emergent wetland vegetation such as common rush, tall flatsedge, lady's thumb, spikerush (*Eleocharis* spp.) floating primrose willow, and common duckweed. The adjacent trees and shrubs are Pacific willow (*Salix lasiandra*), Goodding's black willow, and valley oak.

Seasonal Wetlands

Seasonal wetlands are scattered throughout the southern half of the project area. The vegetation in seasonal wetlands is dominated by herbaceous species such as tall flatsedge, ripgut brome, Hooker's evening primrose (*Oenothera elata*), horseweed (*Conyza canadensis*), common rush (*Juncus effusus*), seashore vervain (*Verbena litoralis*), and Bermuda grass (*Cynodon dactylon*). Based on the lack of a restrictive layer and absence of a plant community with species that are typically found only in vernal pools (e.g., coyote thistle [*Eryngium* sp.]), the seasonal wetlands in the project area were determined to not be vernal pools.

Temporary Impacts

All areas within any project land cover type which incurs temporary impacts to waters of the United States would be restored to their original state following construction. Best management practices and storm water pollution prevention plans would ensure no additional impacts to existing wetlands and waters.

Soils and Substrate

The Natural Resources Conservation Service (NRCS) Soil Survey shows the permanent impacts to jurisdictional waters are mapped within 10 different soil types. Descriptions of the soil types are listed in Table 2-9. Most of the soils have loamy alluvium parent materials, except for the 118 Xerorthents, which are dredge spoils. The soils are found on low slope floodplain and terrace landforms and range from somewhat poorly drained to somewhat excessively drained.

Hydric soils are formed under saturated conditions (due to flooding or ponding) for sufficiently long enough duration during the growing season to form anaerobic conditions in the upper soil layer. The soils support growth of hydrophytic vegetation. The 7 soils with a hydric rating and criteria are also indicated in Table 2-. Five of 7 hydric soils listed are described by the NRCS as only containing minor hydric soil components located in only 3–5% of the soil mapping unit, which means that the soils in the impacted areas themselves may not contain any hydric soil layers.

The predominant soil types of the permanently impacted jurisdictional areas (excluding canals) are 118 Xerorthents, tailings, 0 to 50 percent slopes (45% of area) and 124 Conejo loam, 0 to 2 percent slopes (29% of area). Soil type 118 Xerorthents, tailings is derived from dredged spoil piles from gravelly alluvium derived from igneous, metamorphic and sedimentary rock. The texture of the surface layer is very gravelly sandy loam. It is rated as a hydric soil across 80% of its mapping unit with a hydric rating of 4, which refers to soils that are frequently flooded for long or very long duration during the growing season. Soil type 124 Conejo loam, 0 to 2 percent slopes is derived from loamy alluvium derived from mixed sources. Typically, the surface layer is an approximate 7 inch brown loam and the subsoil is brown loam about 23 inches thick. It is not rated as a hydric soil. The third soil type comprising a substantial portion (17%) of the total impacted area is 121 Boga-Loemstone complex, 0 to 1 percent slopes. It's derived from loamy alluvium over dense silty alluvium derived from igneous and metamorphic rock. The surface layer texture is loam and it is not rated as a hydric soil.

Vegetation

The dominant plant communities in the impacted areas are described above in Section 2.3.3.

Threatened and Endangered Species

Discussion of federally-listed and other special status species is described in detail above in Section 2.3.2 and 2.3.3.

VELB was listed by USFWS as a threatened species on August 8, 1980 (45 FR 52803–52807), due to loss of habitat and inadequate regulatory protection (U.S. Fish and Wildlife Service 2011). The current known range of VELB extends from southern Shasta County, south to Fresno County, and from the east side of the Coast Range to the Sierra Nevada foothills (Barr 1991; U.S. Fish and Wildlife Service 2006). Two critical habitat areas have been designated along portions of the American River in Sacramento County (U.S. Fish and Wildlife Service 1984).

The giant garter snake is the only federally listed species occurring in jurisdictional waters requiring ESA consultation. Critical habitat has not been designated for the giant garter snake.

Table 2-9. Characteristics of Soils in the Impacted Areas

Soil Unit	Parent Material	Slope	Drainage Class	Capacity of Limiting Layer to Transmit Water	Landform	Hydric Rating	Hydric Criteria
Sutter County							
124 Conejo loam, 0 to 2 percent slopes	Loamy alluvium derived from mixed sources	0–2%	Well drained	Moderately high or high (0.57–1.98 in/hr)	Terraces		
126 Conejo-Tisdale complex, 0 to 2 percent slopes	Loamy alluvium derived from mixed sources	0–2%	Well Drained	Moderately High (0.2–0.57 in/hr)	Terraces	Yes ^a	2B3, 4
138 Liveoak sandy clay loam, 0 to 2 percent slopes	Loamy alluvium derived from igneous and metamorphic rock	0–2%	Moderately well drained	Moderately high or high (0.57–1.98 in/hr)	Terraces		
143 Marcum-Gridley clay loams, 0 to 1 percent slopes	Loamy alluvium derived from mixed sources	0–1%	Moderately well drained	Very low (0.00–0.00 in/hr)	Terraces	Yes ^b	2B3, 4
165 Shanghai silt loam, frequently flooded, 0 to 2 percent slopes	Alluvium derived from mixed sources	0–2%	Somewhat poorly drained	Moderately high or high (0.57–1.98 in/hr)	Floodplains	Yes	4
Butte County							
118 Xerorthents, tailings, 0 to 50 percent slopes	Dredged spoil piles from gravelly alluvium derived from igneous, metamorphic and sedimentary rock	0–50%	Somewhat Excessively Drained	High (1.98–4.25 in/hr)	Floodplains	Yes	4
121 Boga-Loemstone complex, 0 to 1 percent slopes	Loamy alluvium over dense silty alluvium derived from igneous and metamorphic rock	0–1%	Moderately well drained	Low to moderately low (0.00–0.06 in/hr)	Terraces		
152 Gianella fine sandy loam, 0 to 1 percent slopes, frequently flooded	Stratified coarse-loamy alluvium derived from igneous, metamorphic and sedimentary rock	0–1%	Moderately well drained	Moderately high or high (1.13–5.38 in/hr)	Floodplains	Yes ^c	4
161 Gianella fine sandy loam, 0 to 1 percent slopes, rarely flooded	Stratified coarse-loamy alluvium derived from igneous, metamorphic and sedimentary rock	0–1%	Moderately well drained	Moderately high or high (1.13–5.95 in/hr)	Floodplains	Yes ^d	2B2
162 Gianella loam, 0 to 1 percent slopes, rarely flooded	Stratified coarse-loamy alluvium derived from igneous, metamorphic and sedimentary rock	0–1%	Moderately well drained	Moderately high or high (0.85–1.98 in/hr)	Floodplains	Yes ^e	2B2
^a Only for the Oswald component, which comprises 3% of the soil mapping unit. ^b Only for the Oswald and Capay components, which comprise a combined 4% of the soil mapping unit. ^c Only for the Columbia, frequently flooded component, which comprises 3% of the soil mapping unit. ^d Only for the Columbia taxadjunct, very fine sandy loam component, which comprises 3% of the soil mapping unit. ^e Only for the Columbia taxadjunct, very fine sandy loam component, which comprises 5% of the soil mapping unit.							
2B2 - A water table at a depth of 0.5 foot or less during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches							
2B3 - A water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr in any layer within a depth of 20 inches.							
4 - Soils that are frequently flooded for long or very long duration during the growing season.							

3.1 Basis for Design

On-site replacement habitat involves replacement of affected habitat with new habitat of the same type and at the same location as the loss. Because much of the affected habitat (specifically, woody vegetation) is not compliant in its location with USACE levee vegetation policy, this option is not considered feasible. Further, the highly dispersed nature of the impact locations makes efficient replacement infeasible. Therefore, on-site replacement was not considered further as a viable option for this project and off-site, in-kind habitat replacement was selected as the best option for mitigation. It involves replacement of affected habitat with the same type of habitat at a different location off-site. This often allows for consolidation of mitigation at a single or small number of sites, allowing for economy of scale and higher quality habitat due to large patch size.

The project will utilize two sub-types of off-site, in-kind replacement:

- **Permittee-responsible mitigation.** This option involves replacement of in-kind habitat on habitat lands operated by the permittee. Two separate sites are proposed for this mitigation option. The first site is the Star Bend Conservation Area (SBCA) on the west levee of the Feather River near river mile 18 is an existing floodplain habitat restoration site that was created as part of the Star Bend setback levee project. The second site is the proposed 500-acre Three Rivers Levee Improvement Authority (TRLIA) Feather River Floodway Corridor Restoration Project (FRFCRP) located on the east bank of the Feather River just upstream of the Star Bend site. Together, both sites contain sufficient area to accommodate all of the project's upland compensatory mitigation and will be used for mitigating impacts to: 1) riparian forest; 2) oak woodland; and 3) VELB.
- **Purchase of credits at commercial mitigation banks.** This option involves replacement of in-kind habitat through purchase of credits issued for habitat lands operated by a commercial mitigation bank. For the aquatic habitat impacts to GGS, the project proposes to purchase credits at the Sutter Basin Conservation Bank, operated by Westervelt Ecological Services in Sutter County, which is the only bank that presently offers giant garter snake credits approved by both the USFWS and CDFW. The project proposes to purchase jurisdictional water credits at the River Ranch Wetland Mitigation Bank, owned and operated by Wildlands, Inc., and located at the confluence of the Sacramento and Feather Rivers in Yolo County. There are currently no mitigation banks that offer oak woodland (non-riparian native tree) credits.

3.2 Characteristics of Design Reference Site

Previous mitigation work was performed at the 48.5-acre SBCA starting in 2009 for the Feather River Setback Levee and Habitat Enhancement Project (Restoration Resources 2010). The work was done as part of a project to replace a portion of the Feather River west levee with a new setback levee approximately 3,400 feet long that begins near the intersection of Star Bend Road and continues southeasterly to the intersection of Tudor Road. For Phase 1A of the project, 37 existing elderberry

shrubs were transplanted. For Phase 1B, 20 acres of elderberry and native associate plants were installed to enhance VELB habitat. For Phase 1C, approximately 2.46 acres of California blackberry (*Rubus ursinus*) and California rose (*Rosa californica*) were planted to protect an area of cultural significance (Restoration Resources 2010). Phase 2 of the Star Bend mitigation project will consist of planting the remaining approximately 24.5 acres. This acreage will be utilized for the mitigation described in this MMP.

The design characteristics used in the initial mitigation work at SBCA will serve as a reference site for the additional VELB mitigation to be performed at Star Bend for this MMP. These characteristics are described in the report *Habitat Enhancement Plan for the Feather River Setback Levee and Habitat Enhancement Project at Star Bend*, prepared by River Partners and Stillwater Sciences in 2009 for Levee District 1 (LD1) and Wood Rodgers.

Design characteristics for riparian forest and oak woodland will incorporate the species composition and plant spacing found in other natural areas in the project site that will not be disturbed. These areas were field mapped, including field inventories of species composition and size. Additional guidance will be provided by the guidelines for Phase 2 riparian habitat planting outlined in River Partners and Stillwater Sciences (2009).

Design of the FRFCRP has not begun, but the site's ecological setting is similar to that found at the SBCA, and it is likely that design principles used at that site could be applied to the FRFCRP.

As described above, mitigation for USACE jurisdictional habitat and GGS will occur off-site at commercial mitigation and conservation banks.

3.2.1 Previous Work Credit

Much of the design information presented below that is specific to the Star Bend site is taken from the report *Habitat Enhancement Plan for the Feather River Setback Levee and Habitat Enhancement Project at Star Bend*, prepared by River Partners and Stillwater Sciences in 2009 for Levee District 1 and Wood Rodgers.

3.3 Proposed Mitigation Site

3.3.1 Location

The SBCA mitigation site is located on the water side (east) of the new setback levee that was constructed in 2009 on the Feather River, approximately six miles south of Yuba City, Sutter County, California (Figures 1 and 2). The 48.5-acre site is just upstream of the Star Bend boat ramp (near River Mile 18) and is bounded on the north and east by a sharp bend in the river. Access by road is from the west via Star Bend Road off of Garden Highway (River Partners and Stillwater Sciences 2009). The property to the east is part of the O'Connor Lakes unit of CDFW's Feather River Wildlife Area. The unit is managed by CDFW and DWR to provide wildlife habitat, restore native plant communities, and convey Feather River flood events. The land to the west of the levee is primarily orchards.

In 2009, LD 1 of Sutter County constructed the Feather River Setback Levee and Habitat Enhancement Project at Star Bend to replace a portion of existing levee that poses a high risk of

failure in order to decrease the flood stage, velocity, and scour potential; increase and improve floodplain habitat; and improve habitat connectivity between the Abbot Lake and O'Connor Lakes Units of CDFW's Feather River Wildlife Area. The SBCA project created approximately 48.5 acres of floodplain habitat, which included habitat enhancement and onsite mitigation for impacted elderberry.

Approximately 20 acres have been used for elderberry transplants and associated native plants. In early 2012, a fire at the SBCA damaged portions of the site; however, VELB planting losses were minimal. The remaining approximately 24.5 acres are available at the conservation area for compensating for impacts on elderberry shrubs, riparian forest, and non-riparian, native trees from construction of the FRWLP.

The FRFCRP site is located on the east side of the Feather River in the levee setback area created by the TRLIA EIP Feather River Setback Levee project (Figure 1). The FRFCRP is located along a section of the Feather River which currently provides over 3,000 acres of wildlife habitat. Restoration on this site is important because it would add another large block of contiguous habitat (approximately 500 acres) along the lower Feather River; thereby reducing habitat fragmentation.

3.3.2 Ownership Status

The SBCA is under joint control by one of SBFCA's member agencies (Levee District 1) and CDFW. The FRFCRP site is entirely owned by TRLIA.

3.3.3 Jurisdictional Areas

There are no known jurisdictional areas in or near the mitigation activities.

3.3.4 Aquatic Functions

The Feather River Setback Levee and Habitat Enhancement Project at Star Bend constructed in 2009, along with the TRLIA EIP Feather River Setback Levee project, increased the amount of floodplain potentially exposed to inundating flows by approximately 1649 acres. The floodplain restoration allows for higher quality floodplain habitat (better water quality, food inputs, and shelter) for juvenile salmonids and other native species such as Sacramento splittail and steelhead. Organic material produced by native deciduous species restored within the floodplain provides an increased nutrient load for the aquatic environment. This influx of nutrients provides for a greater invertebrate population, thereby creating an abundant food source for fish.

3.3.5 Hydrology and Topography

Both the SBCA and the FRFCRP site were once part of a dynamic system of meandering channels and oxbow lakes that covered an area much wider than the levees of the Feather River Flood Control Project. Levee construction, beginning in the 1860's, confined the channel to its present location, and dams on the Feather and Yuba rivers regulate flows (River Partners and Stillwater Sciences 2009).

To the north of the SBCA, overbank flow from the Feather River periodically (i.e., modeled stage of the 2.5- to 3-year recurrence interval flow [approximately 60,000 cfs]) fills the drainage feature and depressions left by dredger mining (Wood Rodgers, Inc. 2007). In the O'Connor Lakes unit, scour channels, debris accumulations in trees and shrubs, and deposits of sand are evidence of periodic

overbank flow. Periodic maintenance on the O'Connor Lakes Unit is conducted by DWR to increase the conveyance of flood flows and transport sediment (River Partners and Stillwater Sciences 2009).

On the land-side of the existing levee system, rain, flood irrigation and seepage under the levee are the primary sources of surface water. Flooding is used to irrigate the orchard crops, occasionally leaving standing water behind for short periods of time following irrigation. The levee ditch was constructed to contain any water seeping under the toe of the levee, but was only inundated in 1986 and 1997, years in which extremely large flood events occurred (B. Hampton, Manager, LD1, pers. comm., 2007). During those events, water remained for a couple of weeks, generally percolating into soil after flood flows had receded (B. Hampton, Manager, LD1, pers. comm., 2007). In 2006, which had a relatively large flood event, there was no water in the levee ditch (B. Hampton, Manager, LD1, pers. comm., 2007) (River Partners and Stillwater Sciences 2009).

The 2010 initial monitoring report for the Star Bend site (Restoration Resources 2010) stated that surface water was present within the 20 acre habitat area in March 2010 due to low depressions that do not provide sufficient drainage, but began to dry out into April. These areas may have stayed inundated due to the more than average rain received in the regional area during the winter and early spring season.

Elevations of the project area average 45 feet above sea level. Topography is generally flat, with steeper gradients at the river's edge. Several small hills and depressions occur in the O'Connor Lakes Unit as a result of overbank flood scour and deposition, and previous soil excavation and habitat enhancement projects (River Partners and Stillwater Sciences 2009).

Hydrologic function and existing topography of the FRFCRP is likely similar to that found at the SBCA.

3.3.6 Soils and Substrate

The Sutter County Soil Survey (Lytle 1988, NRCS 2008) identifies two soil series within the SBCA. The majority of the site consists of mapping unit 124 Conejo loam, 0 to 2 percent slopes. Conejo soils are very deep, well drained soils formed in alluvium and are observed on alluvial fans and stream terraces. Conejo soils contain about 39.2% sand, 37.3% silt and 23.5% clay. They are classified in hydrologic group B, which have moderately low runoff potential when thoroughly wet and water transmission through the soils is unimpeded.

Mapping unit 134 Holillipah loamy sand, 0 to 2 percent slopes occupies the northern boundary of the site along the Feather River. The Holillipah soils, which contain deep sand to loamy sand derived from mixed alluvium, are frequently flooded, and somewhat excessively well drained (River Partners and Stillwater Sciences 2009).

Detailed soil information for the FRFCRP has not been collected.

3.3.7 Vegetation

Vegetation types at the SBCA were assessed during a September 13, 2006 field survey by EIP Associates (EIP Associates 2007) and were mapped and described during wetland delineation surveys conducted in September 2007 and January 2008 by Stillwater Sciences (Stillwater Sciences 2008b) (River Partners and Stillwater Sciences 2009).

Plant species observed during a September 13, 2006 field survey by EIP Associates included wild oats (*Avena fatua*), ripgut brome (*Bromus diandrus*), soft brome (*Bromus hordeaceus*), turkey mullein

(*Eremocarpus setigerus*), wild mustard (*Brassica* sp.), and prickly lettuce (*Lactuca serriola*) (EIP Associates 2007) (River Partners and Stillwater Sciences 2009).

Riparian forest habitat occurs north of the SBCA, throughout much of the levee ditch, and across much of the O'Connor Lakes unit to the southeast. The area north of the existing levee has a dense canopy of native riparian tree species (approximately one acre), including Fremont cottonwood (*Populus fremontii*), Goodding's black willow (*Salix gooddingii*), northern California black walnut (*Juglans californica* var. *hindsii*), Oregon ash (*Fraxinus latifolia*), and valley oak (*Quercus lobata*). There is a sparse to moderately dense shrub layer with arroyo willow (*Salix lasiolepis*), box elder (*Acer negundo*), California button willow (*Cephalanthus occidentalis*), California rose, and narrowleaf willow (*Salix exigua*). The vine layer is thin, containing predominantly California wild grape (*Vitis californica*) and poison oak (*Toxicodendron diversilobum*). The herbaceous layer is generally absent, with small clearings containing black mustard (*Brassica nigra*), oat (*Avena* sp.), perennial pepperweed (*Lepidium latifolium*), seashore vervain (*Verbena littoralis*), and soft brome (River Partners and Stillwater Sciences 2009).

Portions of the Star Bend setback levee ditch (approximately three acres) are predominantly comprised of a mature canopy of valley oak, occasionally shared with blue elderberry (*Sambucus mexicana*). The understory is fairly sparse, with blue wildrye (*Elymus glaucus*), California blackberry, California rose, California wild grape, Goodding's black willow, narrowleaf willow, and poison oak (River Partners and Stillwater Sciences 2009).

The northwest corner of the SBCA includes the recent mitigation work previously described. For Phase 1A of the project, 37 existing elderberry shrubs were transplanted. For Phase 1B, 20 acres of elderberry and native associate plants were installed to enhance VELB habitat. For Phase 1C, approximately 2.46 acres of California blackberry (*Rubus ursinus*) and California rose (*Rosa californica*) were planted to protect an area of cultural significance (Restoration Resources 2010).

The majority of the land west of the SBCA is a plum orchard that is flood irrigated. Annual grass and weedy forb species occur between the rows of trees, but the sparse distribution and short stature of the forbs indicate they are sprayed with herbicides or otherwise controlled on a regular basis (River Partners and Stillwater Sciences 2009).

The FRFCRP is vegetated with non-native annual grasses and forbs and is devoid of any woody vegetation. The site is mostly surrounded by orchards or other agriculture, but there an area of existing riparian vegetation adjacent to the southwest corner.

3.3.8 Present and Historical Uses of the Mitigation Area

Prior to the arrival of Europeans, Native Americans of the Valley Nisenan populations established villages along the Feather River and its tributaries in the vicinity of the site. The northwest corner of the site is a historic low rise along the river and contains an historic record of an indigenous village site (Bayham 2004) (River Partners and Stillwater Sciences 2009).

John Sutter laid claim to the region when he secured the New Helvetia Land Grant in the 1840s. He promptly built Hock Farm, a rancho in the vicinity of the site, which provided cattle stock that ranged freely along Feather River. W. H. Ashford owned and farmed a section of the west bank as early as 1880, which includes most of the site. In 1880, the O'Connor family owned the parcel to the south of the site where the lakes are located (Sutter County 1880). The 1912 (U.S. Army Corps of Engineers 1912) geologic survey shows dredging activities to the north and south of the site, but not within the

site. The 1912 survey also shows that the site had not been cleared for agriculture (River Partners and Stillwater Sciences 2009).

The SBCA is presently being used for the Phase I and Phase II mitigation work previously described. The SBCA converted 55 acres of former orchard and levee into floodplain habitat. Twenty acres of elderberry shrubs and native associate plants for VELB habitat were planted as part of the initial mitigation. The remaining 35 acres were not planted.

The FRFCRP is currently being managed as open floodplain habitat. Prior to inclusion in the setback area created by the TRLIA EIP Feather River Setback Levee project, the site was largely planted in orchard trees.

3.3.9 Present and Proposed Uses of All Adjacent Areas

The Feather River and three other properties surround the SBCA (i.e., Churkin, Singh, and CDFW properties). The majority of the area west of the site on the land side of the levee is a plum (*Prunus* sp.) orchard that is flood irrigated. The existing levee, operated by LD1, and the Star Bend pumping plant also are located along the site's western boundary. The pumping plant includes pump station discharge lines and irrigation pipelines that bisect the northern portion of the site and continue to adjacent properties. All the property to the east of the SBCA is part of the O'Connor Lakes unit of CDFW's Feather River Wildlife Area. The unit is managed by CDFW and DWR to provide wildlife habitat, restore native plant communities, and convey Feather River flood events.

The FRFCRP is surrounded by orchards or other agricultural land uses to the north, south, and east. To the west is an area of riparian vegetation.

3.4 Created/Restored Habitats

3.4.1 Compensation Ratios

The amount of proposed compensation is based on the significance of the habitats affected to fish and wildlife resources, USFWS general fish and wildlife mitigation recommendations (Fish and Wildlife Coordination Act Report), USFWS GGS programmatic biological opinion and VELB Conservation Guidelines. Compensation ratios may be adjusted at the project preconstruction engineering and design stage as a result of further assessments of habitat values and functions in consultation with the USFWS and other resource agencies.

VELB Habitat

Before construction begins, USACE will compensate for direct effects on elderberry shrubs by transplanting shrubs that cannot be avoided to the SBCA. Elderberry seedlings or cuttings and associated native species will also be planted in the conservation area. Each elderberry stem measuring 1 inch or greater in diameter at ground level that is adversely affected (i.e., transplanted) would be replaced, in the Star Bend area, with elderberry seedlings or cuttings at a ratio ranging from 1:1 to 8:1 (new plantings to affected stems). The numbers of elderberry seedlings/cuttings and associated riparian native trees/shrubs to be planted as replacement habitat are determined by stem size class of affected elderberry shrubs, presence or absence of exit holes, and whether the shrub lies

in a riparian or non-riparian area. Stock of either seedlings or cuttings would be obtained from local sources (including the project area if acceptable to USFWS).

At the discretion of USFWS, shrubs that are unlikely to survive transplantation because of poor condition or location, or a plant that would be extremely difficult to move because of access problems, may be exempted from transplantation. In cases where transplantation is not possible, minimization ratios would be increased to offset the additional habitat loss.

The relocation of the elderberry shrubs will be conducted according to USFWS-approved procedures outlined in the Conservation Guidelines (U.S. Fish and Wildlife Service 1999a). Elderberry shrubs within the project construction area that cannot be avoided will be transplanted during the plant's dormant phase (November through the first 2 weeks of February). A qualified biological monitor will remain onsite while the shrubs are being transplanted.

Property inaccessibility and the high density of vegetation along portions of the Feather River riparian corridor limited the number of elderberry shrubs that could be surveyed (73 shrubs were surveyed). For this reason, compensation for the removal of approximately 162 shrubs was estimated based on the average number of stems in each stem diameter range for the 73 shrubs that could be surveyed (see Table 3-1). Those averages are as follows.

- Number of stems ≥ 1 inch and ≤ 3 inches = 4.
- Number of stems > 3 inches and < 5 inches = 1.
- Number of stems ≥ 5 inches = 1.

Because most of the shrubs are located in riparian habitat and did not have exit holes, the compensation ratios for these conditions were used.

Table 3-1. Estimated Compensation for Elderberry Shrubs Removed

Stem Diameter	Number of Stems ¹	Seedling Ratio ²	Native Plant Ratio ²	Total Seedlings	Total Native Plants
Stems ≥ 1 " to ≤ 3 "	648	2:1	1:1	1,296	1,296
Stems > 3 " to < 5 "	162	3:1	1:1	486	486
Stems ≥ 5 "	162	4:1	1:1	648	648
Total	972			2,466	2,466

N/A = not applicable.

¹ The number of stems per shrub was based on the average number of stems in each stem diameter range for the 72 shrubs that could be surveyed. Those averages are as follows: number of stems ≥ 1 " and ≤ 3 " = 4; number of stems > 3 " and < 5 " = 1; and number of stems ≥ 5 " = 1.

² Ratios are based on shrubs within riparian habitat with no VELB exit holes.

Based on the information in Table 3-1, 493 elderberry units, or 20.38 acres, will be required to fully mitigate for project impacts per USFWS VELB Conservation Guidelines. All of this mitigation will occur at the SBCA.

Riparian Habitat and Oak Woodland

Project impacts would be mitigated at a 2:1 compensation ratio as listed in Table 3-2. The USFWS Draft Fish and Wildlife Coordination Act Report (FWCA report) recommended at least a 2:1 replacement ratio to compensate for loss in functions and values.

USACE Section 404 Jurisdictional Areas

Project impacts would be mitigated at a 2:1 compensation ratio per the USFWS FWCA report. Of the 5.178 acres of impact (Table 2-8), approximately 4.10 acres would be compensated onsite in conjunction with relocation of the Sutter Butte canal.

Table 3-2. Anticipated Project Impacts to Sensitive Resources and Proposed Compensatory Mitigation

Impact Type	Impact Unit	Impact Quantity	Mitigation Need	Mitigation Area
Riparian Forest and Riparian Scrub Shrub	acres of cover type	42.50 acres	85.00 acres (2:1 replacement ratio ¹)	85.00 acres at 10' o.c. plant spacing
Oak Woodland	acres of cover type	1.30 acres	2.60 (2:1 replacement ratio ¹)	2.60 acres at 10' o.c. plant spacing
Elderberry	individual shrubs and total stem count within each shrub	162 shrubs with 972 total stems	162 transplants, 2,466 elderberry seedlings, and 2,466 native associates	20.38 acres ² (493 elderberry units)
Giant Garter Snake	acres of permanent impact	0.00 aquatic 3.54 acres upland	3.54 acres (3:1 replacement ratio ³)	10.62 acres
Jurisdictional Waters	acres of permanent impact	1.71 acres	3.42 acres (2:1 replacement ratio ¹)	3.42 acres

Notes:

¹ Compensation ratio from USFWS Draft Fish and Wildlife Coordination Act Report .

² Compensation acreage determined based on USFWS VELB Compensation Guidelines.

³ Compensation ratio from USFWS Programmatic Biological Opinion (U.S. Fish and Wildlife Service 1997)

To fully mitigate for project impacts, approximately 87.60 acres of land will be required (elderberry transplantation/compensation (20.38 acres) met through riparian forest compensation). If all of the 24.5 acre SBCA Phase 2 land is used for mitigation purposes, approximately 63.10 acres of land would be required at the FRFCRP site to accommodate the remaining mitigation.

Compensation for GGS and Section 404 wetland impacts would be met by purchase of 14.04 acres of equivalent credit through mitigation or conservation banks (i.e., Sutter Basin Conservation Bank and River Ranch Wetland Mitigation Bank).

3.4.2 Long-Term Goal(s)

The long-term ownership goal is to merge the SBCA with CDFW's adjoining O'Conner Lakes and Abbott Lakes Wildlife Units. A similar goal with an appropriate public agency is also envisioned for the FRFCRP.

Given the presence of good soils and potential exposure to frequent flooding, both project areas should sustain rapid growth of restored riparian species throughout the life of the project implementation (approximately 3 years). An “over-planting” approach is used to rapidly establish native riparian species. Over-planting the project site will eliminate the need for any additional replanting efforts. The ultimate ecological objective for over-planting is that in time the area will thin out and create a complex of open canopy, dense forest, and dead snags, all of which provide benefits to wildlife (River Partners and Stillwater Sciences 2009).

It is anticipated that at the end of the 3-year establishment period, 70% survivorship of woody species will be attained. Over time, mortality based on differences of soil textures and water table depths will create areas of complex, open canopy, dense forest, and dead snags, all of which create habitat for wildlife (River Partners and Stillwater Sciences 2009).

3.4.3 Aquatic Functions

No jurisdictional open water habitat will be created at the either site. The Feather River Setback Levee and Habitat Enhancement Project at Star Bend, together with the TRLIA EIP Feather River Setback Levee project, increased the amount of floodplain potentially exposed to inundating flows by approximately 1649 acres. The floodplain restoration allows for higher quality floodplain habitat (better water quality, food inputs, and shelter) for juvenile salmonids and other native species such as Sacramento splittail and steelhead. Organic material produced by native deciduous species restored within the floodplain provides an increased nutrient load for the aquatic environment. This influx of nutrients also provides for a greater invertebrate population, thereby creating an abundant food source for fish. The additional mitigation plantings for VELB habitat and plantings for riparian forest and non-riparian, native trees proposed for this MMP will further increase the food inputs and shelter for aquatic species by expanding the acreage of floodplain forest and upland habitat at the site (River Partners and Stillwater Sciences 2009).

3.4.4 Hydrology and Topography

The long-term source of water for the new SBCA and FRFCRP mitigation plantings will be groundwater and Feather River flood flows. After the plants have become established enough to discontinue irrigation, groundwater will be the primary source of water. Additional surface water flooding will be provided during when the Feather River flows, most often high during spring and early summer snowmelt. Hydraulic modeling shows that the Feather River overbanks at locations north of the Star Bend site approximately once every 2.5 to 3 years (Wood Rodgers, Inc. 2007, as cited in River Partners and Stillwater Sciences 2009). It is anticipated that flooding will occur at the proposed mitigation site on a similar recurrence interval frequency. The duration of flooding will depend upon water year type. In some years, the river will not overtop its banks and inundate the site. In other years, flooding may occur over a period of several days, while in the wetter years the site could be flooded for several weeks. Flood water that overbanks into the site will generally flow downgradient from the north to south and eventually infiltrate into the ground or recede back into the river when the river’s flood stage decreases.

3.4.5 Soils and Substrate

The majority of the SBCA consists of 124 Conejo loam soils, which are very deep, well drained soils formed in alluvium and are observed on alluvial fans and stream terraces. They are classified in

hydrologic group B, which have moderately low runoff potential when thoroughly wet and water transmission through the soils is unimpeded. These soils are highly suitable for supporting elderberry shrubs and associated plants for VELB habitat, and for supporting riparian and non-riparian tree species. The same species that will be planted in the soils at the SBCA are currently growing in the same soils in lands in the site's vicinity.

Detailed soil information has not been collected at the FRFCRP site.

3.4.6 Vegetation

The target plant communities and species at the SBCA and FRFCRP site will include riparian forest, non-riparian native trees, and elderberry shrubs and associated plants for VELB habitat (Table 3-3).

Table 3-3. Woody Planting Species for Star Bend Conservation Area

Common Name	Scientific Name
Coyote brush	<i>Baccharis pilularis</i>
Mule fat	<i>Baccharis salicifolia</i>
Buttonbush	<i>Cephalanthus occidentalis</i>
California Rose	<i>Rosa californica</i>
California Blackberry	<i>Rubus ursinus</i>
Sandbar willow	<i>Salix exigua</i>
Arroyo willow	<i>Salix lasiolepis</i>
Blue elderberry	<i>Sambucus mexicana</i>
Valley oak	<i>Quercus lobata</i>
Interior live oak	<i>Quercus wislizeni</i>
Oregon ash	<i>Fraxinus latifolia</i>
Fremont cottonwood	<i>Populus fremontii</i>
Box elder	<i>Acer negundo</i>

The detailed planting plan is described below in Section 5.2.

Chapter 4

Success Criteria and Monitoring

4.1 Success Criteria

For this MMP, a “success criterion” is a measure that indicates whether the mitigation goals have been achieved at the end of the monitoring period. The mitigation will be evaluated annually using the annual performance standards. Table 4-1 summarizes the monitoring success criteria for restored and enhanced wetlands, drainages, and upland and riparian areas.

Table 4-1. Monitoring Success Criteria for Planted Areas at the SBCA and FRFCRP site

Riparian Vegetation, Oak Woodland, Elderberry, and Non-Riparian Native Vegetation		
<i>Monitored Characteristic</i>	<i>Monitoring Year</i>	<i>Success Criteria Standards</i>
Plant survival	1-2	Demonstrate at least 80% survival of all riparian vegetation and Oak Woodland plantings after 2 years.
Plant survival	3	Demonstrate at least 70% survival of all riparian vegetation and Oak Woodland plantings after 3 years.
Plant survival	4-20	Demonstrate at least 60% survival of all riparian vegetation and Oak Woodland plantings after 20 years.

Riparian Vegetation, Oak Woodland, Elderberry, and Non-Riparian Native Vegetation

A minimum survival rate of at least 80% must be maintained throughout the first 2 years of the monitoring period. A minimum survival rate of at least 70% must be maintained at the end of the third year. A minimum survival rate of at least 60% at the end of 20 years. Within one year of discovery that survival has dropped below the respective percent for each monitoring year, failed plantings will be replaced to bring survival above this level. USACE in consultation with the resource agencies will make any determination as to replacement responsibilities arising from circumstances beyond its control, such as plants damaged or killed as a result of severe flooding or vandalism.

4.2 Monitoring

4.2.1 Methods

Monitoring will be quantitative and qualitative. The monitoring methods that will be used during the annual performance monitoring are described below by habitat and restoration/mitigation category.

Annual Surveys

At the end of the first growing season, the restoration contractor will conduct a complete census of all woody species planted. The data are best analyzed using a database to calculate survivorship, and to determine any changes to or omissions from the original planting design. During years two and

three, woody species plantings will be sampled to determine survivorship, growth, and coverage. Sampling of native grass and herbaceous understory plantings will also be conducted (River Partners and Stillwater Sciences 2009).

Census

At the end of the first growing season, a census noting survivorship for each location (alive, dead, or missing/not planted) will be conducted. The census allows for pattern analysis to examine the effects of soil, hydrology, or other factors affecting survivorship. During implementation, changes in the planting design are possible (or even desirable) and should be noted. Deviations in planting can also be recorded during the census. Results of the census will be used to determine progress towards performance criteria and replanting, if necessary (River Partners and Stillwater Sciences 2009).

Permanent Plot Sampling

After the initial census, subsequent monitoring (years 2 and 3) utilizes permanent plots to collect data on overall survivorship, height, and cover. The sampling procedure is modified for a restoration setting from protocol developed by Dr. Dave Wood (CSU, Chico) to establish permanent plots in riparian forests (personal communication). Some of the methods have been adapted from Elzinga et al. 1998. Comparison of survivorship between the sampling procedure and census indicates that sampling estimates are within 2% and provide additional information on cover and recruitment (results based on data from field 4 of the Ord Bend Unit, Sacramento River National Wildlife Refuge (River Partners 2003)). The sampling procedure may also be used to compare pre- and post-restoration vegetation, if the permanent plots are installed beforehand (River Partners and Stillwater Sciences 2009).

Plot location and Size

All samples are based on 20 m x 50 m (1,000 m²) plots (quadrats) placed with the long axis oriented in a north-south direction. Permanent plot locations will be selected by stratifying the field and using the grid cell method (overlying each field with a 20 m x 50 m grid) to select sampled plots. Plots that extend past the plantable area are generally rejected. In addition, we exclude locations that are not characteristic of that particular area. In general, a plot should be established every 5-20 acres. The plots serve as areas to collect information on woody, shrub, and herbaceous species (if desired) (River Partners and Stillwater Sciences 2009).

Once each specific plot location is randomly selected, its field location will be permanently recorded at the upstream, inland corner of the plot. The position will be recorded with a GPS unit, and, in subsequent monitoring years, will be reestablished in the same position (River Partners and Stillwater Sciences 2009).

Measurements

At each plot, cover and height measurements of all shrubs and trees inside the 20 m x 50 m plot will be recorded. To assess the survivorship of planted species, we will note their status: alive, dead, or missing (not planted). Because restoration activities often create conditions that favor the survivorship and natural recruitment of native plants, newly recruited native riparian woody species will also be recorded. The estimate of aerial cover of both trees and shrubs will be based on the longest diameter through the horizontal plane of the plant's drip line, a thin line at which a drop

of water would fall from the outward most oriented leaf (River Partners and Stillwater Sciences 2009).

4.2.2 Monitoring Schedule

The riparian forest and oak woodland non-riparian native tree restoration areas will be monitored annually during Years 1 through 5 following completion of mitigation project implementation. First year monitoring will not be completed until after one full growing season for vegetation has passed since completion of construction. The implementing agency will submit an annual report at the end of each monitoring year and a final report to USFWS and other resource agencies for review and approval. These areas will be monitored annually during May or June.

The population of valley elderberry longhorn beetles, the general condition of the conservation area, and the condition of the elderberry and associated native plantings in the conservation area must be monitored over a period of either ten (10) consecutive years or for seven (7) years over a 15-year period. The applicant may elect either 10 years of monitoring, with surveys and reports every year; or 15 years of monitoring, with surveys and reports on years 1, 2, 3, 5, 7, 10, and 15. The conservation plan provided by the applicant must state which monitoring schedule will be followed. No change in monitoring schedule will be accepted after the project is initiated. If conservation planting is done in stages (i.e., not all planting is implemented in the same time period), each stage of conservation planting will have a different start date for the required monitoring time. In any survey year, a minimum of two site visits between February 14 and June 30 of each year must be made by a qualified biologist (River Partners and Stillwater Sciences 2009).

4.2.3 Photo-Documentation

The progress of the restoration areas will be documented photographically. Permanent photo-documentation stations will be established at several points throughout both sites. The locations of photo-documentation stations will be determined during the first year of the monitoring period, and the locations will be identified in the field and mapped, either on a map or by using a GPS receiver.

The number of photographs taken at a given photo-documentation station will vary, depending on the area and habitat. Photos will include panoramic views taken from a high point at the site that will not be obscured in future years by growing vegetation. A sufficient number of stations will be established to ensure that the photographs provide a visual record of the sites. Photographs will be taken during June of each monitoring year. Additional representative photographs may be taken at other times of the year at the implementing agency's discretion.

5.1 Site Preparation

5.1.1 Avoidance Measures

Site preparation during the first phase of work will involve implementing the following avoidance measure actions related to preconstruction surveys and construction staking.

- Stake the limits of the work area, including construction, staging, and access areas.
- Perform pre-construction surveys for giant garter snake, western pond turtle, nesting birds/raptors, native bats and valley elderberry longhorn beetle.
- Stake the limits of Environmentally Sensitive Areas (ESAs).
- Place protection fencing around the perimeter of ESAs.
- Place silt fencing, when appropriate, around the perimeter of ESAs.
- Perform preconstruction surveys of affected drainages.

Prior to construction, the construction contractor, under the supervision of SBFCA, will survey and stake the location of the work area and ESAs. These locations will be based on the project construction documents prepared by SBFCA and will be in accordance with this MMP.

The construction contractor will install protective fencing and/or silt fencing according to the specifications in the project construction documents around ESAs to be preserved. Protective fencing will consist of orange plastic-mesh fencing that is secured to metal T-posts. To prevent soil or sediment from entering sensitive areas, silt fencing may be installed around areas to be preserved. Silt fencing may be used in combination with protective fencing and will be installed in accordance with the Stormwater Pollution Prevention Plan that will be prepared by the contractor and the best management practices identified in the project construction documents. This silt fence will also serve as exclusion fencing to aid in preventing wildlife from entering active construction areas.

Prior to initial ground disturbance, preconstruction surveys for giant garter snake, western pond turtle, nesting migratory birds/raptors, and roosting bats will be conducted to ensure that these sensitive species are not directly or indirectly affected by restoration activities. Nesting bird and raptor surveys will be conducted no more than 14 days prior to the start of construction to ensure that no active bird nests are present within 50 feet and no raptor nests are present within 300 feet of restoration activities. A bat emergence survey will also be conducted within 14 days prior to construction to ensure that no trees supporting maternal roosts are present within or adjacent to restoration activities.

If a special-status species is identified within or adjacent to restoration activities, appropriate no-disturbance buffers will be established for breeding sites or the individual(s) will be allowed to passively move out of the construction area. Buffers will be determined by a qualified biologist, coordinating with the appropriate regulatory agency, and will depend on the species identified and

one or more of the following factors: season of activity, level of noise or construction activity, level of ambient noise in the vicinity, and line-of-sight.

5.1.2 Pest Plant Removal

Weed control is necessary for the successful establishment of native plants and improvement of habitat. The weeds of greatest concern at the site are black mustard, yellow starthistle and pepperweed (River Partners and Stillwater Sciences 2009).

In areas to be planted with herbaceous species, spraying and mowing for an entire season before planting is recommended. Once the herbaceous species are planted, weed control methods will be mowing, possibly applying 2,4-D to control broad leaf pressure. The restoration contractor will abide by county and state herbicide permitting and reporting requirements. Roundup® (glyphosate) and 2,4-D (for broad-leaf control in native grass planting) are likely to be the most commonly used herbicides on the project. Rodeo® (for areas adjacent to water bodies), Telar® (for pepperweed control), Poast® (for post-emergence control of annual grasses in herbaceous understory planting) and Garlon™ (for woody species control) may also be used (River Partners and Stillwater Sciences 2009). No herbicide will be applied on days when wind speed is high enough to cause drift onto adjacent natural or planting areas.

Phase 2 planting areas that are within 200' of any elderberry plantings or transplants in the Phase 1 planting area will not be sprayed with any herbicide during site preparation activities. Only hand or mechanical weed removal methods will be employed in these areas.

Herbicide and pesticide application actions require compliance with a Statewide General National Pollutant Discharge Elimination System (NPDES) permit process for residual pesticide discharges to waters of the United States. The SBFCA site management representative will ensure compliance with the NPDES permit.

5.1.3 Construction Monitor

An individual familiar with this mitigation and monitoring plan will supervise all phases of construction of the project. These phases may include:

- Layout of proposed other waters of the United States boundaries prior to construction.
- Placement and installation of ESA fencing.
- Site preparation/vegetation clearing operations.
- Planting and seeding operations.

The construction monitor will have authority to direct equipment operators and will submit a summary report to USACE documenting construction observations and any problems that arise.

5.2 Planting/Seeding

5.2.1 Planting Plan

A conceptual planting plan and plant palette for the SBCA is shown in Figures 3 and 4. Planting of the SBCA and FRFCRP site will consist of the following species for Elderberry mitigation, riparian mitigation, oak woodland (non-riparian native tree mitigation) and upland seed mix (Tables 5-1 through 5-4):

Table 5-1. Plant Palette for Elderberry Mitigation Areas

Scientific Name	Common Name	Percent of Planting Mix	Plant Spacing (feet on-center)	Container Size
<i>Sambucus mexicana</i>	Blue elderberry	50	10' O.C.	1-gallon
<i>Baccharis pilularis</i>	Coyote brush	10		1-gallon
<i>Populus fremontii</i>	Fremont cottonwood	10		1-gallon
<i>Rosa californica</i>	California rose	10		1-gallon
<i>Quercus lobata</i>	Valley oak	10		1-gallon
<i>Salix lasiolepis</i>	Arroyo willow	5		1-gallon
<i>Salix exigua</i>	Sandbar willow	5		1-gallon

Table 5-2. Plant Palette for Riparian Mitigation Areas

Scientific Name	Common Name	Percent of Planting Mix	Plant Spacing (feet on-center)	Container Size
<i>Populus fremontii</i>	Fremont cottonwood	25	10' O.C.	1-gallon
<i>Box elder</i>	Acer negundo	12.5		1-gallon
<i>Oregon ash</i>	Fraxinus latifolia	12.5		1-gallon
<i>Rosa californica</i>	California rose	10		1-gallon
<i>Quercus lobata</i>	Valley oak	10		1-gallon
<i>Salix lasiolepis</i>	Arroyo willow	10		1-gallon
<i>Salix exigua</i>	Sandbar willow	10		1-gallon
<i>Rubus ursinus</i>	California blackberry	5		1-gallon
<i>Cephalanthus occidental</i>	Buttonbush	5		1-gallon

Table 5-3. Plant Palette for Oak Woodland (Non-Riparian Native Tree Mitigation Areas)

Scientific Name	Common Name	Percent of Planting Mix	Plant Spacing (feet on-center)	Container Size
<i>Quercus lobata</i>	Valley oak	75	10' O.C.	1-gallon
<i>Baccharis pilularis</i>	Coyote brush	15		1-gallon
<i>Quercus wislizeni</i>	Interior live oak	10		1-gallon

Table 5-4. Upland Seed Mix

Botanical Name	Common Name	Pounds Pure Live Seed Per Acre
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(Slope Measurement)		
In-Stream Bench Seeding (Type 1)		
<i>Leymus triticoides</i>	Creeping wild rye	10
<i>Hordeum brachyantherum ssp californicum</i>	Meadow barley	12
<i>Elymus glaucus</i>	Blue wild rye	12
<i>Eschscholizia californica</i>	California poppy	2
<i>Lupinus succulentus</i>	Arroyo lupine	4
<i>Triticum x Elymus</i>	Regreen	25

5.2.2 Nature and Source of Propagules

Container plants will be purchased from a commercial nursery located within two hours of the project site. If possible, container plants will be grown from seeds or cuttings collected at or near the project site in order to populate the site with species ecotypes that are adapted to local ecological conditions.

5.3 Irrigation

Because of the dry summers typical of the climate in the area, irrigation will be required for plant establishment and survival. Irrigation should be applied with the goal that plants will become self-sufficient by the end of the third growing season (River Partners and Stillwater Sciences 2009).

In the first growing season, the rapidly growing seedlings have roots only in the surface (the top 1–2 feet) of the soil profile. The rooting zone must be kept moist through the season to ensure optimum growth and survival. Because of the sandy soils at the site and water table depths of over 20 feet, the soil moisture of the fields planted with woody species will need to be closely monitored. The intervals between irrigations are dependent upon soil texture, depth to water table, the weather conditions, and plant water stress. Because a mixture of species with different water demands is proposed, the plants must be carefully observed to maintain a balance of soil moisture that is acceptable for xeric species like valley oak and elderberry as well as more mesic species like cottonwood and willow (River Partners and Stillwater Sciences 2009).

Prior to project implementation, a more detailed irrigation design will be developed. All irrigation water at the SBCA will be provided by an existing well located in the O'Connor Lakes Unit, near the midpoint of the eastern edge of the project area. The mainline will run west from the well (River Partners and Stillwater Sciences 2009). Irrigation water at the FRFCRP site will be supplied from existing wells on-site.

Based on knowledge of the site and plant design, the following are expected to be the requirements for the system:

- The plant spacing throughout most of the restoration and mitigation areas will be 10-foot-wide rows with a 10-foot distance down the planting rows, and rows planted in an approximate east-west direction.
- Planting rows will curve and run parallel to flood flows. The irrigation system will utilize existing wells as water sources.

- The drip-line emitters will be spaced, with three emitters per plant 12 inches apart. The design flow will be 0.6 gallons per hour per emitter (1.8 gallons per plant per hour).

Within selected areas, soil-moisture sensors will be placed throughout both planting areas. Sensors will be installed at depths of 12 and 36 inches (River Partners and Stillwater Sciences 2009).

In conjunction with these measurements, plant stress observations before and after irrigation periods will be necessary to critically judge the timeliness and effectiveness of irrigation. Measurements provide the most direct assessment of soil moisture. Table 5-5 provides the irrigation goals of the project (River Partners and Stillwater Sciences 2009).

Table 5-5. Irrigation Goals for the Star Bend Conservation Area

Year	Goal	Frequency
1	Keep the shallow roots (1–2 feet) of young plants moist to ensure optimum growth and survival.	Utilize soil moisture probes to monitor and maintain moisture throughout the soil column.
2	Encourage deep rooting and enhance field access to facilitate weed control.	Deliver less frequent but longer irrigations.
3	Encourage deep rooting and enhance field.	Continue with long irrigations and extend the access to facilitate weed control period between irrigations.
Source: River Partners and Stillwater Sciences 2009		

The strategy for the second and third year is to train the roots to grow deep. Roots at depth (5–15 feet) will need less water and may be able to tap into the water table on the site and outcompete more shallow-rooted weeds. Less frequent, deep watering will encourage roots to grow deeper, well below the roots of the weeds, allowing the tree exclusive use of this deep moisture. As the tree's roots grow deeper, the times between irrigations become longer; this allows the soil surface layers to dry, thereby reducing weed vigor (River Partners and Stillwater Sciences 2009).

We anticipate that the well-drained, sandy soils, and relatively deep groundwater present on the site, will require frequent irrigations and careful observation of water stress. These areas may dictate the frequency of watering on the site. Field managers should use a combination of methods including evapotranspiration estimates, soil probes, gypsum blocks, and plant water stress signs to assess soil moisture and alter the irrigation regime (River Partners and Stillwater Sciences 2009).

5.4 Implementation Schedule

The mitigation project would be implemented concurrent with project construction. Elderberry shrub transplant activities would take place during the dormant period. Mitigation maintenance will begin immediately following completion of the mitigation activities.

6.1 Maintenance Activities

6.1.1 Overall

Mitigation and riparian vegetation enhancement activities at the SBCA and FRFCRP site will be monitored by SBFCFA and/or CDFW (or their designee) to determine if mitigation requirements and habitat enhancement goals and performance standards are being met. Annual monitoring of riparian vegetation establishment, including natural native plant recruitment, nonnative plant recruitment, and plant development, will determine if remedial actions are needed. Annual monitoring reports will be submitted by December 31 of each year. If monitoring reveals that performance standards are not being met, remedial activities may be implemented (River Partners and Stillwater Sciences 2009).

6.1.2 Irrigation

All planted areas within the mitigation site will be irrigated during the establishment period. Soil moisture should be checked at least twice weekly and plantings should be qualitatively assessed for signs of drought stress. All planting areas will be irrigated at least twice weekly from May through October. Irrigation event duration should be adjusted depending on soil moisture and prevailing weather conditions but should be of sufficient length to maintain vigorous plant growth and encourage deep root growth.

Between November and April soil moisture at the mitigation site will be checked twice a month, and, if necessary, the irrigation system will be run for approximately ½ hour or long enough to replenish soil moisture around the plantings in the mitigation area.

6.1.3 Invasive Plant Control

Weeding efforts will occur on a monthly basis from April to October of each year for 5 years. Weed control will consist of controlling populations of invasive weeds when they occur in the planting areas. Weed control will consist of mechanical or manual removal only. At no time will herbicides be used in the planted areas. Plant Replacement

Dead or diseased plants will be replaced immediately upon their discovery with new plants of the same size and species. Plant species substitutions will only be permitted with the prior approval of the resource manager.

6.1.4 Plant Replacement

Dead or diseased plants will be replaced immediately upon their discovery with new plants of the same size and species. Plant species substitutions will only be permitted with the prior approval of the resource manager.

6.1.5 Irrigation System Maintenance

The resource manager will maintain the irrigation system during the plant establishment maintenance period. Maintenance will include the repair and replacement of parts, ensuring the system is delivering the required amount of water, and ensuring the system is fully operational at all times. The resource manager will regularly inspect the irrigation system, adjust and replace parts as necessary.

6.1.6 Reporting and Record Keeping

The resource manager will prepare and keep current a record of monthly maintenance performed on the project. The record will identify, at a minimum, project name, mitigation planting zones, current date and establishment period. The record will also identify and discuss weed control performed, irrigation activity and maintenance, plant health, vandalism, site feature conditions, general observations, total precipitation for the month, personnel onsite and any other pertinent information describing site conditions and activities performed during the month.

7.1 Due Dates

USACE will notify resource agencies of the due date (month and day) for the annual monitoring report.

7.2 As-Built

As-built planting and irrigation drawings of the mitigation areas will be prepared by the implementing agency following completion of the project. The as-built drawings will be prepared on 40-scale or larger-scale maps and will indicate the following features.

- Extent of planting areas (in plan view).
- Location of any permanent markers (e.g., identification stakes, photo documentation stations).
- Seeded areas.
- Other pertinent features.

Any changes from the original mitigation construction plans will be indicated in indelible red ink. The as-built drawings will be submitted to USACE and other resource agencies within 6 weeks of construction completion.

7.3 Annual Reports

7.3.1 File Number

Any appropriate USACE permit/file numbers will be included on correspondence, including the cover and title page of all reports.

7.3.2 Contents

The following text describes the content that will be included in the mitigation monitoring reports.

Years of Full Monitoring

Annual monitoring report will be prepared by SBFCA in accordance with USACE guidance (U.S. Army Corps of Engineers 2004 and 2006) by December 31 of each monitoring year. Each full-year monitoring report will include the following information.

- Project Information
 - Project name and a summary of the project location and description including date of project commencement and completion.

- Contact information for the applicant.
- A list of the names, titles, and companies of the people who prepared the content of the annual report or participated in monitoring activities that year.
- USACE permit file number.
- Type and acres of impacted habitat.
- The monitoring year.
- Information on any required performance bonds or surety, if applicable.
- Compensatory Mitigation Site Information
 - Location of the mitigation site.
 - Purpose and goals of the mitigation.
 - Dates of mitigation site construction and completion.
 - Dates and summary of maintenance and performance monitoring visits.
 - Contact information for the responsible party for the mitigation site.
 - Summary of remedial actions, if applicable.
- Figures and Graphics
 - Location map.
 - Mitigation site map indicating restored habitats, monitoring locations, photo documentation stations, and any other pertinent site features.
- List of USACE-approved success criteria
- Monitoring Results
 - A summary and analysis of the monitoring results, including an evaluation of site conditions in the context of the performance standards and success criteria, including a comparison with previous monitoring years.
 - Summary of field data taken to determine compliance.
- Problems noted and proposed remedial measures
 - Problems noted during the course of the monitoring surveys or other site visits.
 - Management recommendations, including discussion of areas with inadequate performance and recommendations for remedial action.
- Appendices
 - Original data sheets and technical appendices, as required by USACE and other resource agencies.
 - Photo-documentation of the planting areas using photographs taken during the monitoring surveys.

Final Monitoring Report

A final monitoring report will be submitted by SBFCA after all performance monitoring at the mitigation site is complete. The final report will be prepared by a qualified biologist and will evaluate whether the mitigation has achieved the goals and success criteria set forth in the approved MMP. The final report will be submitted within 90 days of the end of the monitoring period to USFWS and other resource agencies for review and approval.

8.1 Initiating Procedures

If the final report indicates that the mitigation project has been unsuccessful, in part or in whole, based on the approved success criteria for physical and ecological functions, the implementing agency will evaluate the causes for not meeting the criteria and submit a revised or supplemental mitigation plan within 90 days of the end of the monitoring period for the review and approval of USFWS to compensate for those portions of the original program that did not meet the approved success criteria. The approved remedial measures will be developed based on the qualitative and quantitative monitoring results to determine the most effective remedy. The revised mitigation plan containing the remedial measures will be processed as an amendment to the original permit unless USFWS determines that no permit amendment is required.

If, after all remedial measures have been implemented, it becomes evident that the permit requirements cannot be satisfied according to the proposed mitigation plan, the implementing agency will coordinate with the permitting agencies to develop a contingency plan to be approved by all parties.

8.2 Contingency Funding Mechanism

USACE and SBFCA will fund any necessary contingency mitigation efforts, including additional planning, implementation, and monitoring.

Chapter 9

Completion of Mitigation Responsibilities

9.1 Notification

USACE will notify USFWS of completion of mitigation responsibilities in conjunction with the final annual report. A minimum of 2 years will be required after the completion of all maintenance activities (e.g., irrigation, replanting, rodent control, fertilization) before final success criteria will be considered met.

9.2 USFWS Confirmation

After receiving the final monitoring report, USFWS will conduct a site visit and confirm in writing to the implementing agency that the mitigation obligations and responsibilities have been met, or if not met, describe additional actions required.

10.1 Property Ownership

The SBCA is owned in part by LD 1 and in part by CDFW. The FRFCRP site is entirely owned by TRLIA.

10.2 Management Plan

10.2.1 Purpose

This section only addresses permittee-responsible mitigation, as compensatory mitigation not addressed below will be deemed satisfied and complete through purchase of credits from a commercial mitigation bank approved by the appropriate resource agencies.

The purpose of this long-term management plan is to ensure the mitigation site is monitored and maintained in perpetuity. This management plan provides management objectives and tasks to monitor, manage, maintain and report on the mitigated natural resources. Routine monitoring and minor maintenance tasks are intended to assure the viability of the mitigation site's functions and values. This long-term management plan will take effect after the completion of the monitoring period, once it has been determined by the appropriate resource agencies that the mitigation project has achieved its project objectives and outlined performance standards for each habitat type have been reached. During the long-term management period the gradual withdrawal of the required support systems (e.g., irrigation and frequency of maintenance) for mitigation resources will begin. The goal for each mitigation site is to become fully self-sustaining. The designated resource manager(s) will oversee all long-term management activities.

10.2.2 Resource Manager

The resources managers are LD1 and DFW. The resource managers, and subsequent resource managers, upon transfer, shall implement this long-term management plan. Long-term management tasks shall be funded through the mitigation site's endowment fund. The resource manager(s) shall be responsible for providing an annual report, consisting of a description of the management tasks and total funds expended, to the appropriate resource agencies. Any subsequent modification to the mitigation sites by the resource manager(s) or their representatives must be approved by the appropriate resources agencies and the necessary permits obtained.

10.2.3 Management Approach

The general management approach to the long-term maintenance of the mitigation site will be to maintain quality habitat functions and values for each mitigated resource and on-going monitoring and maintenance of the mitigation site. When necessary, adaptive management will be used to adjust management practices, including corrective actions as determined to be appropriate by the

appropriate resources agencies in discussion with the resource manager(s). Adaptive management includes those activities necessary to address the effects of climate change, fire, flood, or other natural events, force majeure, etc. Before considering any adaptive management changes to the long-term management plan, the appropriate resource agencies will consider whether such actions will help ensure the continued viability of the mitigation site's biological resources.

10.2.4 Long-Term Management Needs

The expected long-term management needs and activities necessary to maintain the mitigation site will be resource specific long-term maintenance activities as described below and other general maintenance activities such as exotic species elimination, clean-up and trash removal, infrastructure management such as gate, fence, road, culvert, signage and drainage-feature repair, and other maintenance activities necessary to maintain the functions and values of the mitigation site.

Biological Monitoring

Annual field surveys will be conducted to qualitatively assess and record the general conditions of the riparian, non-riparian native trees, and elderberry planting areas. General hydrology, general vegetative cover, structure and native plant diversity, invasive species, and erosion sites will be recorded, evaluated and mapped during site examinations in the spring. Notes to be made will include observations of species encountered, general condition of the planting areas, occurrences of erosion, and presence of significant populations of non-native invasive plants.

Diversity of native plant species will be maintained by replanting native species as specified in the original planting plan, or when appropriate, introduction of additional native species. Native species from various plant communities should be selected to complement natural seral processes that may take place as the mitigation site ages and matures.

Other Site Management Activities

Other site management and maintenance activities are those that may be required on an as-needed basis. Items listed below may be observed, implemented, and/or recorded during annual site observation and included in annual report to the appropriate resource agencies. Funding for these management and maintenance activities will be covered by the mitigation site's endowment fund.

General Inspections: The resource manager(s) will conduct two general site inspections each year. These inspections may take place while conducting other routine site maintenance visits. Photo documentation will be collected. Permanent photo points for taking photographs will be established, and a site map showing the photo point will be prepared for the mitigation project file. Representative photographs will be taken once per year during the same season.

Mosquito Abatement: Potential mosquito abatement issues will be addressed through the development of a plan by the resource manager(s) and the mosquito and vector control district in coordination with and approved by the appropriate resource agencies.

Trash and Trespass: At least once yearly trash will be collected and disposed within the mitigation site. Vandalism and trespass impacts will be repaired and rectified. Sources of trash and trespass will be monitored.

Non-native Invasive Species: The resource manager(s) will monitor and maintain control over non-native invasive species, including but not limited to noxious weeds, that diminish site quality for which the mitigation project was established. The mitigation site currently functions with a number of nonnative species, some of which have become naturalized. They are predominantly annual species that occur in grasslands. It is unreasonable to require or expect eradication of established nonnative species at the site. The required management of nonnative plants therefore will be limited to the management of newly introduced invasive species and controlling the spread of existing invasive species. Methods of removing or controlling these species are outlined below.

Hand/mechanical: Hand removal or use of small hand-powered or handheld equipment (such as a Weed Wrench or a chainsaw) always should be the preferred method of removing invasive species from the mitigation properties. If hand-removal methods are found ineffective, or the problem is too widespread for hand removal to be practical, mechanical methods (use of larger equipment with motors such as mowers) or biological controls as described below can be used.

Biological controls: The county agricultural commissioner would be the point of contact for use of biological controls in the mitigation properties.

At no time will herbicides be utilized at the mitigation site.

Weeding will be done on an as-needed basis starting in March and ending in October.

Each year's annual walk-through survey (or a supplemental survey) will include a qualitative assessment (e.g., visual estimate of cover) of potential or observed noxious weeds or other non-native species invasions, primarily in or around the wetlands. Additional actions to control invasive species will be evaluated and prioritized.

Fire Hazard Reduction: Potential wildfire fuels will be reduced as needed by mowing in areas where approved by the resource agencies. The site will be maintained as required for fire control while limiting impacts to biological values. Vegetation will be mowed in areas required by authority agency(ies), and as approved by the appropriate resource agencies, for fire control.

Reporting and Administration

The resource manager(s) will provide an annual report on all management tasks conducted and general site conditions to appropriate resource agencies and any other appropriate parties. The annual report will be completed and circulated to the appropriate resource agencies and other parties by August 15 of each year. The report will make recommendations with regard to any habitat enhancement measures deemed to be necessary, any problems that need near short and long-term attention (e.g., weed removal, erosion control), and any changes in the monitoring or management program that appear to be warranted based on monitoring results to date.

10.2.5 Management Responsibilities and Plan Modification

Transfer of Management Responsibilities

Any subsequent transfer of management responsibilities under this long-term management plan to a different resource manager shall be requested in writing by the existing resource manager(s). The request shall be made to the appropriate resource agencies, which will issue written approval that shall be incorporated as an amendment into this long-term management plan. Any subsequent

property owner assumes resource manager responsibilities described in this long-term management plan and as required in the conservation easement, unless otherwise amended in writing by the appropriate resource agencies.

Amendment to Management Plan

The resource manager(s), property owner, and the resource agencies may meet and confer from time to time, upon the request of any one of them, to revise the long-term management plan to better meet management objectives and preserve the habitat functions and values of the mitigation site. Any proposed changes to the long-term management plan shall be discussed with the appropriate resource agencies and the resource manager(s). Any proposed changes will be designed with input from all parties. Amendments to the long-term management plan shall be approved by the appropriate resource agencies in writing and implemented by the resource manager(s).

10.2.6 Funding

Long-Term Funding Mechanism

An endowment will be provided by the implementing agency to CDFW who will hold the principal and interest monies as required by law in a deposit fund, or subsequent state authorized trustee fund which consists of monies that are paid into it in trust pursuant to law, and will be appropriated to fulfill purposes for which payments into it are made. These interest monies will fund the long-term management, enhancement and monitoring activities set forth by the conservation easement and consistent with this long term management plan.

The resource manager(s) shall consult with CDFW as required to determine the amount of funding available for management and monitoring activities.

10.2.7 Long-Term Conservation Mechanism

Conservation Easement

Conservation easements will be created for the portion of the SBCA owned by LD, and the entire FRFCRP site. They will act as a legal binding agreement to restrict the use of the parcel for the purpose of conserving in perpetuity the mitigated natural resources. The conservation easement will be attached to the property's fee title and apply to present and all future owners and resources managers of the mitigation site should LD1 relinquish or transfer land management responsibilities.

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Figures

SUTTER BASIN PILOT FEASIBILITY STUDY COST EFFECTIVENESS INCREMENTAL COST ANALYSIS REPORT

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List of Acronyms and Abbreviations

CE/ICA	cost-effectiveness/incremental cost analysis
DFW	California Department of Fish and Wildlife
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
MMP	Mitigation and Monitoring Plan
Project	Feather River West Levee Project applicant-preferred alternative
SBFCA	Sutter Butte Flood Control Agency

Draft Sutter Basin Pilot Feasibility Study Cost Effectiveness and Incremental Cost Analysis

Analysis Scope and Objective

This document is a cost effectiveness incremental analysis of the options for mitigating habitat and jurisdictional waters impacts associated with the SB 8 alternative and Sutter Butte Flood Control Agency's (SBFCA's) Feather River West Levee Project applicant-preferred alternative (Project).

For the purpose of this analysis, the two alternatives are treated the same because they are nearly perfectly congruent in construction footprint and activity, with the exceptions that SB 8 extends slightly farther to the south and has minor variations in staging and borrow areas. The difference in the southern limit is considered scalable between the two alternatives and would not represent different effect types, relative effect magnitude, or mitigation options. The differences in the staging and borrow areas is considered insignificant to this analysis because resultant habitat effects would be predominantly temporary and would not require habitat mitigation. Therefore, these differences are not discussed further in this analysis.

This analysis is presented in compliance with ER 1105-2-100 (April 22, 2000) and its included guidance on cost-effectiveness/incremental cost analysis (CE/ICA). It is intended to determine the least-cost solution for habitat mitigation for the project.

Project Description, Impacts, and Mitigation Needs

The project consists of levee improvements in a 41-mile corridor along the west levee of the Feather River from the Thermalito Afterbay downstream to approximately 3 miles north of the confluence with the Sutter Bypass. The levee improvements include mostly slurry cutoff walls with short segments of seepage berms and other location-specific measures like removal or treatment of encroachments.

Potential borrow sites that could supply the soil borrow material necessary for levee construction and upgrades, and routes from the project construction area to the borrow sites, are also included as part of the work. It is not anticipated that all sites would be used over the multi-year phased construction period but would be available for use if the need arises.

Existing Ecological Resources

Table 1 provides a summary of all existing land cover types within the Project area.

Table 1. Acreages of Existing Land Cover Types in the Project Area

Land Cover Type	Permanent Impacts for Which Mitigation Is Required?	Unit	Levee Construction Footprint ^a	Borrow Sites ^a	Total
Terrestrial					
Riparian Forest	Y	acre	252.71	9.97	262.68
Oak woodland	Y	acre	0.35	0	0.35
Orchard	N	acre	1212.89	0	1212.89
Field and row crops	N	acre	147.65	50.59	198.24
Wet agriculture (rice)	N	acre	0	348.08	348.08
Developed	N	acre	404.68	20.94	425.62
Ruderal	N	acre	903.24	82.96	986.20
Aquatic					
Freshwater emergent wetland	N	acre	0.57	0	0.57
Seasonal wetland	Y	acre	12.23	0	12.23
Open water	Y	acre	59.32	4.7	64.02
Tailing ponds	Y	acre	6.44	3.59	10.03
Stream	N	acre	0.17	0	0.17
Canal/ditch	Y	acre	22.51	0.64	23.15
Wet agriculture (rice)	N	acre	0	35.74	35.74

^a Accuracy to 0.01 acre is subject to $\pm 5\%$ accuracy depending upon the accuracy of aerial imagery and topographic maps.

Significant Losses to Ecological Resources, Impact Units and Proposed Mitigation

Detailed discussion of the project impacts may be found in the Project's Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS). Table 2 summarizes the project's impacts to sensitive ecological resources, impact unit of measure, and the proposed compensatory mitigation ratios and quantities.

Table 2. Anticipated Project Impacts to Sensitive Resources and Proposed Compensatory Mitigation

Impact Type	Impact Unit	Impact Quantity	Mitigation Need	Mitigation Area
Riparian Forest and Riparian Scrub Shrub	acres of cover type	42.50 acres	85.00 acres (2:1 replacement ratio ¹)	85.00 acres at 10' o.c. plant spacing
Oak Woodland	acres of cover type	1.30 acres	2.60 (2:1 replacement ratio ¹)	2.60 acres at 10' o.c. plant spacing
Elderberry	individual shrubs and total stem count within each shrub	162 shrubs with 972 total stems	162 transplants, 2,466 elderberry seedlings, and 2,466 native associates	20.38 acres ² (493 elderberry units)
Giant Garter Snake	acres of permanent impact	0.00 aquatic 3.54 acres upland	3.54 acres (3:1 replacement ratio ³)	10.62 acres
Jurisdictional Waters	acres of permanent impact	1.71 acres	3.42 acres (2:1 replacement ratio ¹)	3.42 acres

Notes:

¹ Compensation ratio from USFWS Draft Fish and Wildlife Coordination Act Report.

² Compensation acreage determined based on USFWS VELB Compensation Guidelines.

³ Compensation ratio from USFWS Programmatic Biological Opinion (U.S. Fish and Wildlife Service 1997)

Mitigation Planning Objectives and Potential Mitigation Strategies

The mitigation planning objective for this project is to provide compensatory mitigation at resource agency approved ratios for all permanent impacts to sensitive ecological resources.

There were four primary habitat mitigation solutions considered, listed below with a statement of applicability.

- **In-lieu fee program.** This option, wherein a permittee/applicant pays the permitting agency to implement mitigation at its discretion, generally has low favorability with the agencies requiring mitigation because it shifts the burden of responsibility for providing replacement habitat from the applicant/permittee to the permitting agency. It is often regarded as a “last resort” and typically applies only to very small projects and impacts where other mitigation options may not be feasible, upon negotiation with the permitting agency. Approved in-lieu fee programs may not exist for all mitigation needs in the project area. For this combination of reasons, in-lieu fee programs were not considered further as a viable solution for this project.
- **Out-of-kind replacement habitat.** This option involves replacement of habitat with a different type than that which was impacted, either on-site or off-site. Because in-kind replacement habitat is not feasible, this option was not considered further as a viable solution for this project.

- **On-site replacement habitat.** This option involves replacement of affected habitat with new habitat of the same type and at the same location as the loss. Because much of the affected habitat (specifically, woody vegetation) is not compliant in its location with USACE levee vegetation policy, this option is not considered feasible. Further, the highly dispersed nature of the impact locations makes efficient replacement infeasible. On-site replacement was not considered further as a viable option for this project.
- **Off-site, in-kind replacement habitat.** This option involves replacement of affected habitat with new habitat of the same type but at a different location than the loss. This often allows for consolidation of mitigation at a single or small number of sites, allowing for economy of scale and higher quality habitat due to large patch size. There are two sub-types:
 - **Permittee-responsible mitigation.** This option involves replacement of in-kind habitat on habitat lands operated by the permittee. Permittee-responsible mitigation is considered viable and is addressed in the Mitigation and Monitoring Plan (MMP) developed for the project.
 - **Purchase of credits at commercial mitigation banks.** This option involves replacement of in-kind habitat through purchase of credits issued for habitat lands operated by a commercial mitigation bank. Purchase of credits is considered viable and is addressed in the MMP developed for the project.

Permittee-Responsible Mitigation. Permittee-responsible offsite mitigation involves securing an appropriate mitigation site, implementing the mitigation plan, monitoring its performance, maintaining the site during the establishment period, developing a conservation mechanism, and arranging a source of funding for long-term protection of the site.

The Star Bend and TRLIA Feather River mitigation sites are existing floodplain habitat restoration sites that were created as part of the Star Bend setback levee and Feather River setback levee projects, respectively. Together, both sites contain sufficient area to accommodate all of the project's upland compensatory mitigation, consisting of mostly woody vegetation. Aquatic habitat mitigation, including giant garter snake habitat and jurisdictional waters, could be created through restoration of a rice field used for soil borrow for the project.

Table 3 provides a summary of the permittee-responsible mitigation and the anticipated costs. Appendix 1 contains detailed construction and establishment cost breakdowns for each category to establish a unit cost for equitable comparison between mitigation solutions (i.e., "apples-to-apples" comparison).

Table 3. Permittee-Responsible Mitigation Costs

Mitigation Type	Location	Quantity	Unit	Cost per Unit	Cost
Oak Woodland	Star Bend	1.30	Acres	\$36,684	\$47,689
Oak Woodland	TRLIA Feather River	1.30	Acres	\$36,684	\$47,689
Elderberry (New Plantings)/Riparian Forest Mitigation ¹	Star Bend	493	Units	\$1,488	\$733,584
Riparian Forest	Star Bend	4.12	Acres	\$35,855	\$147,722
Riparian Forest	TRLIA Feather River	60.50	Acres	\$35,855	\$2,169,228
Elderberry (Transplants)	Star Bend	162	Each	\$1,200	\$194,400
Giant Garter Snake	Restored rice field	10.62	Acres	\$40,291	\$427,890
Jurisdictional Waters	Restored rice field	3.42	Acres	\$164,167	\$561,452
				Total	\$4,329,654

¹ Riparian forest mitigation can be met through elderberry mitigation.

Mitigation Bank. Purchase of mitigation bank credits involves utilizing a commercial mitigation bank or banks to fulfill the project's compensatory mitigation obligation. The mitigation bank or banks would need to have been approved by the permitting agencies for the habitat types and service area that covers the impact.

Currently there is not one mitigation bank that can solely fulfill all of the credit types needed for the project's mitigation requirements. For the upland habitat impacts, the River Ranch Elderberry Conservation Bank, owned and operated by Wildlands, Inc., is located at the confluence of the Sacramento and Feather Rivers in Yolo County. This bank can fulfill the riparian and elderberry mitigation requirements of the project. There are currently no mitigation banks that offer oak woodland (non-riparian native tree) credits.

For the aquatic habitat impacts, the Sutter Basin Conservation Bank, owned and operated by Westervelt Ecological Services in Sutter County, is the only bank that presently offers giant garter snake credits approved by both the U.S. Fish and Wildlife Service and California Department of Fish and Wildlife (DFW). Jurisdictional water credits are available at the River Ranch Wetland Mitigation Bank (discussed above).

Table 4 provides a summary of the agency-approved mitigation credits available at the banks in the service area of the impacts.

Table 4. Mitigation Bank Costs

Mitigation Type	Location	Quantity	Unit	Cost per Unit	Total
Oak Woodland	None	2.60	Acres	\$50,000 ¹	\$130,000
Elderberry (New Plantings) and Riparian Forest Mitigation ²	River Ranch Elderberry Conservation Bank	493	Units	\$4,000	\$1,972,000
Riparian Forest		64.62	Acres	\$100,000	6,462,000
Elderberry (Transplants)		162	Each	\$1,200	\$194,400
Giant Garter Snake	Sutter Basin Conservation Bank	10.62	Acres	\$40,000	\$424,800
Jurisdictional Waters	River Ranch Wetlands Mitigation Bank	3.42	Acres	\$100,000	\$342,000
Total					\$9,525,200

¹Estimate; no market credits are available at this time.

²Riparian forest mitigation can be fulfilled through purchase of elderberry credits

Summary of Results

The total cost for the permitted responsible mitigation option is \$4,329,654. The total cost for the mitigation bank option is \$9,525,200. On a cost per unit basis, the most cost-effective solution would be a blend between the two options, as shown below in Table 5.

Table 5. Unit Cost Comparison

Mitigation Type	Unit	Permittee-Responsible Mitigation Cost per Unit	Mitigation Bank Cost per Unit	Most Cost-Effective Solution
Oak Woodland	acre	\$36,684	\$50,000*	Permittee-responsible
Elderberry (New Plantings)/Riparian Tree Mitigation	unit	\$1,488	\$4,000	Permittee-responsible
Elderberry (Transplants)	each	\$1,200	\$1,200	Permittee-responsible/Mitigation bank
Giant Garter Snake	acre	\$40,291	\$40,000	Mitigation bank
Jurisdictional Waters	acre	\$164,167	\$100,000	Mitigation bank

*Estimate; no market credits are available at this time.

Therefore, in accordance with ER 1105-2-100 (Appendix E, page 153), the most cost-effective plan is a combination of permittee-responsible mitigation and purchase of credits at a commercial mitigation bank, as no other plan costs less, and no other plan yields more output for less money.

This blended solution is detailed in Table 6. The total compensation cost using this solution is about \$4.6 million.

Table 6. Most Cost-Effective Mitigation Solution

Mitigation Type	Location	Quantity/ Unit	Cost per Unit	Total
Oak Woodland	Star Bend or TRLIA Feather River	2.6 acres	\$36,684	\$95,378
Elderberry (New Plantings)/Riparian Tree Mitigation	Star Bend	493 units	\$1,488	\$733,584
Elderberry (Transplants)		162 each	\$1,200	\$194,400
Riparian Forest	Star Bend or TRLIA Feather River	4.12 acres	\$35,855	\$147,722
Riparian Forest	TRLIA Feather River	60.50 acres	\$35,855	\$2,169,228
Giant Garter Snake	Sutter Basin Conservation Bank	22.5 acres	\$40,000	\$900,000
Jurisdictional Waters	River Ranch Wetlands Mitigation Bank	3.42 acres	\$100,000	\$342,000
Total				\$4,582,312

There are other factors influencing favorability of this blended solution. One such factor is that oak woodland mitigation is not presently available at a bank, meaning a bank-only solution is not feasible. Moreover, enhancement of the Star Bend restoration area is favored by the permitting agencies to more fully realize the floodplain habitat potential for this area for fish and wildlife. Additionally, the Star Bend site is under joint control by one of SBFCA's member agencies (Levee District 1) and CDFW, easing issues with maintenance, ownership, and protective status in conservation. Conversely, these issues are not resolved for a permittee-responsible aquatic mitigation site, increasing the favorability of mitigation bank solution for these impacts.

Nearly half (\$2.4 million) of the total mitigation cost of 4.6 million is endangered species compensation. The remainder is primarily compensation for loss of riparian forest. Riparian forest is a significant resource based on scarcity, institutional and public significance criteria. It is estimated that 95 percent of pre-European acres of riparian habitat in California's Central Valley have been lost to recent human activities.

An incremental cost analysis was not performed because there were no breakpoints where the incremental cost per unit changed dramatically with increasing cost and where less than full compensation for riparian forest may be justified based on incremental costs. In part, this was a result of using acres of habitat rather than habitat units as the output metric to compare measures.

More detailed analyses using habitat based modeling methods such as Habitat Evaluation Procedures may be performed during future design phases to ensure that significant habitat function and values are compensated for and the most cost effective and incrementally justified solution is identified.

Appendix A

Mitigation Cost Tables

Table A1. Elderberry Mitigation Costs at Star Bend

Habitat Feature	Task Description	Unit	Unit Cost	Quantity	Total Cost	Assumptions
Elderberry plantings at Star Bend (20.38 acres)	Mobilization	LS	\$15,000	1	\$15,000	
	Container plant	EA	\$20	4,932	\$98,640	Assumes 5 elderberry and 5 associates per unit (242 plants/acre)
	Irrigation system	AC	\$8,500	20.38	\$173,230	Assumes flood proof drip system
	Irrigation POC	EA	\$15,000	1	\$5,000	Assumes pumping out of Feather River
	Maintenance Years 1-4	LS	\$42,298	1	\$107,462	Assumes 20% mortality for Years 1-3 and 10% for Year 4
	Monitoring Years 1-10	LS	\$92,400	1	\$160,000	
	15% Contingency				\$83,548	
Total					\$642,880	

Table A2. Non-Riparian Native Tree Mitigation Costs at Star Bend and TRLIA Feather River

Habitat Feature	Task Description	Unit	Unit Cost	Quantity	Total Cost	Assumptions
Oak plantings at Star Bend and TRLIA Feather River (20.14 acres)	Mobilization	LS	\$15,000	2	\$30,000	
	Container plant	EA	\$20	10,180	\$203,600	Assumes 10' O.C. spacing
	Acorn plantings	EA	\$3	10,120	\$30,360	Assumes 500 acorns/acre
	Irrigation system	AC	\$8,500	20.14	\$171,190	Assumes flood proof drip system
	Irrigation POC	EA	\$15,000	1	\$15,000	Assumes utilizing existing well
	Maintenance Years 1-4	LS	\$107,462	1	\$107,462	Assumes 20% morality for Years 1-3 and 10% for Year 4
	Monitoring Years 1-10	LS	\$84,000	1	\$84,000	
	15% Contingency				\$97,203	
Total					\$738,815	

Table A3. Riparian Mitigation Costs at Star Bend

Habitat Feature	Task Description	Unit	Unit Cost	Quantity	Total Cost	Assumptions
Riparian plantings at Star Bend (9.51 acres)	Mobilization	LS	\$15,000	1	\$15,000	
	Container plant	EA	\$20	4783	\$95,660	Assumes 10' O.C. spacing
	Irrigation system	AC	\$8,500	9.51	\$80,835	Assumes flood proof drip system
	Maintenance Years 1-4	LS	\$16,657	1	\$67,887	Assumes 20% morality for Years 1-3 and 10% for Year 4
	Monitoring Years 1-10	LS	\$13,950	1	\$37,200	
	15% Contingency				\$44,475	
Total					\$340,977	

Table A4. GGS Mitigation at Generic Permittee-Responsible Site

Habitat Feature	Task Description	Unit	Unit Cost	Quantity	Total Cost	Assumptions
GGS (7.5 acres aquatic and 15 acres upland)	Land cost	AC	\$7,500	22.5	\$168,750	
	Mobilization	LS	\$15,000	1	\$15,000	
	Grading	CY	\$4	36,300	\$145,200	Assumes 3' of cut over 7.5 acres and on-site spoils disposal
	Seeding	AC	\$1,000	22.5	\$22,500	Assumes seeding over all 22.5 acres
	Planting	EA	\$3	15,090	\$45,270	Assumes plug planting at 5' O.C. over 7.5 acres
	Erosion control	LS	\$5,000	1	\$5,000	
	Design and permitting	LS	\$46,594	1	\$46,594	Assumes 20% of construction costs
	GGS monitoring	YR	\$8,000	5	\$40,000	
	Endowment	LS	\$300,000	1	\$300,000	Assumes \$6,000/year for long term maintenance and monitoring at 2% annual return on principal
	15% Contingency				\$118,247	
Total					\$906,561	

Table A5. Jurisdictional Habitat Mitigation at Generic Permittee-Responsible Site

Habitat Feature	Task Description	Unit	Unit Cost	Quantity	Total Cost	Assumptions
Wetlands and waters (3.42 acres)	Land cost	AC	\$7,500	6	\$45,000	Assumes approximately 2.5 acres of upland for spoils disposal and buffer
	Mobilization	LS	\$15,000	1	\$15,000	
	Grading	CY	\$4	16,552	\$66,208	Assumes 3' of cut over 3.41 acres and on-site spoils disposal
	Seeding	AC	\$1,000	6	\$6,000	Assumes seeding over all 6 acres
	Planting	LS	\$3	9,309	\$27,927	Assumes plug planting at 5' O.C. over 3.42 acres
	Erosion control	LS	\$5,000	1	\$5,000	
	Design and permitting	LS	\$24,027	1	\$24,027	Assumes 20% of construction costs
	Wetland monitoring	YR	\$12,000	5	\$60,000	
	Endowment	LS	\$200,000	1	\$200,000	Assumes \$4,000/year for long term maintenance and monitoring at 2% annual return on principal
	25% Contingency				\$112,290	
Total					\$561,452	